AGENCE POUR L’ÉNERGIE NUCLÉAIRE
NUCLEAR ENERGY AGENCY

COMMITTEE ON THE SAFETY OF NUCLEAR INSTALLATIONS
SUB-COMMITTEE ON LICENSING

PROCEEDINGS OF THE SPECIALISTS’ MEETING
ON REGULATORY INSPECTION PRACTICES IN
NUCLEAR POWER PLANTS
PART-II

Hosted by the Junta de Energía Nuclear, Spain
SESSION III, SPECIFIC PROBLEMS AND PRACTICAL
EXPERIENCE OF REGULATORY INSPECTION DURING -
COMMISSIONING
Conclusions of Session III

Papers were presented by representatives from Spain, Sweden, United Kingdom and the U.S. Two of them, those from Spain and the U.K., can be said to be oriented towards administrative practices, the other two were problem and experience oriented. The papers balanced each other in the meaning that they covered different aspects of inspection during commissioning. They defined the commissioning phase somewhat differently and in one case also dealt with some questions concerning the routine operation phase. This can be seen as an indication that many problems of inspection are common to all phases and that others are interrelated from phase to phase.

Some questions were mentioned by all speakers. One of these was the witnessing of tests by inspectors. That procedure is used in all four countries and in itself deemed necessary although it was also noticed that it might cause delays for the licensee if not carefully planned from both sides. The use of independant consultants was mentioned as a mean to expand the capacity of the authority and to reach independancy in the inspection procedure itself.

The Swedish speaker pointed out that in his country there was a lack of inspecting personnel with operating experience from power plants. The situation is similar in Spain, while authorities in both the U.K. and the U.S. have managed to recrute inspectors with that experience although recruitment of less experienced people who are trained in house, is being very common.

Delays during the construction phase were mentioned as causing delays during commissioning as well as delays caused by licensees not preparing their test programs in due time. One obvious reason for delays in the commissioning process is of course modification of the plant or of the design parameters required by unacceptable test results.

Other problems which were mentioned:

- undefined or varying qualifications for personnel used for pre-service inspection
- inability to follow planned frequencies for the inspection at the plants
- undesired interaction between reactors in different phases
(e.g., construction and commissioning) on a twin-reactor station
- the use of different codes (e.g., these of ASME) for plants
  according to their age
- the time needed for the power ascension program

One question which was not mentioned in the papers, but which was taken up to discussion and comments during the panel discussion, concerned the fuel. Which are the specific problems of fuel handling during commissioning and how are those related to later stages of life of the plant?

One question which certainly arises from this session - as from session II and IV - is the following: what are inspectors doing in their work compared to what they ought to do and to what they believe they do? Is Inspection their main task or are they as well doing assessment and other jobs?
INSPECTION DURING THE STARTING-UP PHASE OF NUCLEAR POWER PLANTS IN SPAIN

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Dentro del programa nuclear español, existen siete unidades que han recibido ya el Permiso de Construcción, y de estas, tres se encuentran en avanzado estado de construcción (más del 75%), y cercanas a la fase de verificación prenuclear. La primera parte de la comunicación se refiere al tratamiento técnico del arranque de una central nuclear en España según la reglamentación legal vigente. La segunda parte trata la problemática relacionada con las inspecciones en servicio, en especial la de referencia.

Within the Spanish nuclear program, there are seven units which have received building permits, and of these, three are in the advanced building stage (over 75%), and close to starting the prenuclear tests phase. The first part of this report deals with technical treatment referring to the commissioning of a nuclear power plant in Spain in view of the provisions set forth by the Regulations on Nuclear Installations. The second part of the report deals with the problems related to the application of in-service inspections, in particular with the reference inspection.
1. INTRODUCTION

The supply of electrical energy from nuclear sources commenced in Spain in the year 1968 with the starting of the "José Cabrera" (Zorita) nuclear power plant. One decade has gone by from that date until now, and at present, Spanish nuclear potential has grown to the extent that there are three nuclear power plants in operation, a further 7 in various stages of construction, and about 12 pending official licensing, which means a growth from 160 MWe in 1968 to an expected 18,000 - 20,000 MWe in 1985-86.

This considerable increase has forced all sectors concerned to work with advanced technology, from the owner-electric companies, components manufacturers, construction-assembly companies, inspection agencies and auxiliary industries, down to the Administration itself.

In particular, tests during the starting-up phase of a nuclear power plant, both in the pre-nuclear and nuclear phase itself, no longer are carried out solely according to the set rules applied in other similar plants, but are undertaken using a mixed system of applying experience gained in the field together with "reference plant" concept.

2. ADMINISTRATIVE REGULATIONS

In Spain, the starting-up phase (commissioning) of a nuclear power plant is dealt with in Chapters 4 and 5 of Title II of the Regulation on Nuclear and Radioactive Installations, in force since 1972. Article 20 of said Regulation textually states: "Pre-nuclear tests will be understood as tests, verifications and checks to be carried out in each of the different systems which comprise the installation (plant), once these have been incorporated into same, and in any event prior to the intake of nuclear substances or the loading of nuclear fuel".

Also, Article 24 states: "... the carrying out of nuclear tests which shall be understood to be the tests and checks to be carried out in the installation (plant) after the intake of nuclear substances or the loading of nuclear fuel, including in same the different phases of experimental operation which allow basic data to be obtained for an evaluation of the installation's nuclear safety condition".
We can deduce from the foregoing that in Spain, the nuclear tests commence with the initial loading of nuclear fuel, and end when, by means of trials, it is proven that the requirements for nuclear safety, radiological protection and quality assurance set out in the Preliminary and Final Safety Reports are met in a practical sense, in accordance with the design and construction.

On looking at the date of the Regulation, 24th October, 1972, it can be observed that the three nuclear power plants in operation, José Cabrera (PWR), Santa María de Garoña (BWR) and Vandellós (GCR), were not subject to its rules. With regard to the setting-up phase, the three plants were tested by the supplier himself, as these projects were undertaken using a "turn-key" system, by which the principal suppliers (Westinghouse, General Electric and SOXIA respectively), took charge of the design, construction, assembly and starting-up tests, handing over the plant to the operator.

Once the Regulations came into force in 1972, the plants under construction found that their start-up programs had to be adapted to the provisions of Regulations. In particular, the documentation which the permit applicant (electric company or group of companies) has to present to the Administration, follows the administrative formalities which are included in Annex I, and included in the application documentation for the Provisional Operation Permit.

3. PRE-NUCLEAR TESTS

For pre-nuclear tests, the holder of the construction permit (the applicant) may propose a global or staggered test program, and he is responsible for executing same. These tests and verifications must "guarantee the adequate performance of the equipment or component parts which comprise the installation, both with regard to nuclear safety and radiological protection, and in accordance with Spanish industrial and technical regulations", (Art. 21). Compliance with the guarantee and quality control during this phase is insured as the applicant is obliged to carry out a quality control program for the components and equipment related to nuclear safety. (Art. 21).
The Regulations indicate the main points of the start-up program contents when it points out that "the pre-nuclear tests shall aim to insure the correct performance of the system or the adequacy of the installation's characteristics in relation to the following points:

1. Mechanical conditions of the installation, strength and leakproof qualities.

2. Prolonged performance of the elements when subjected to alternate or cyclical stresses.

3. Heat conditions, temperature resistance and dilation compatibility.

4. Thermodynamic conditions, heat transfer and extraction.

5. 1. Radioactivity regulation and control systems 
   2. Nuclear safety systems.

6. Radiation containment and efficiency of the protective shields, if and wherever necessary.

7. Systems for emergency protection and elimination of radioactive waste, and

8. Electrical supply systems."

However, it is also indicated that specific considerations, applicable in each case, will be taken into account.

The documentation normally presented by the applicant consists of three basic documents:

- Organization manual of the start-up personnel.

- Program and timetable for pre-nuclear tests, and

- Basic procedures (preliminary) for pre-nuclear tests.
Each of the three basic documents is evaluated in the following manner:

- **Organization Manual**: an audit is made of the technical-administrative method of the start-up Manual, with special attention being given to the following points:
  - Organization of the start-up personnel
  - Start-up program administration
  - Start-up documentation control
  - Design modifications and changes during start-up
  - Maintenance during tests
  - Equipment cleaning and protection
  - Test instrumentation equipment
  - Training of test personnel
  - Labelling and marking of components, equipment and systems
  - Tested systems delivery procedures.

- **Start-Up Program**: the list of tests to be carried out is reviewed, comparing same with the index presented in Appendix A of the USAEC Regulatory Guide 1.68, revised in November 1973, which should be complied with by Spanish installations as a consequence of the "reference plant" concept previously mentioned.

- **Start-Up Timetable**: the applicant proposes the dates, for carrying out the tests, using a graph or PERT, which should be comprehensive.

- **Basic procedures**: each programmed test is described and evaluated by means of a thorough check emphasizing that the minimum contents should be:
  - Object of the test
  - Pre-requisites
  - Initial conditions
  - Reference documents
  - Precautions, limits and signal points
  - Instructions and step-by-step check lists
  - Criteria for approval of results
  - Labelling and system discharging
  - Signature sheet (preparation, revision, approval...)
  - Personnel and equipment required.
During the period of start-up documents evaluation, several technical meetings are held with the applicant in order to carry out audits and to request additional documentation, if necessary. Inspection visits are also organized to the site, to observe the condition of the offices and start-up files.

Once the evaluation has been completed, which supposes an average effort of 20-30 weeks x man, a preceptive report is drawn up for presentation to the Energy Administration Board, which in turn issues the authorization for pre-nuclear verification of the installation, if appropriate and this authorization "will indicate the tests and checks which, within the scope of the approved program, must be carried out in the presence of specialized personnel from the Provincial Delegations of the Ministry of Industry or the personnel appointed by the Energy Administration Board and the Nuclear Energy Board (JEN). In each case, the official representative shall issue an official report which summarizes the tests carried out and the results obtained. The permit holder may make any comments he considers pertinent, for their inclusion in the official report" (Art. 22).

Included in each authorization is the list of tests in which the obligatory presence of the JEN inspectors is required; the hold-point tests normally selected are:

- Containment spray system.
- Emergency electrical system (diesel, batteries).
- Cold hydrostatic test of the primary cooling system.
- Tightness and integrity of the containment area.
- Hot functional test of the primary cooling system.
- Emergency core cooling system.
- Reactor protection and radiation surveillance systems.
- Control room ventilation system.
- Essential component cooling system.
- Checking of nuclear fuel handling tools.
- Communications system.
- Firefighting system.

In addition, it is normally required that a physical protection system (anti-sabotage) for the plant be functioning before the start-up tests are commenced. Of the above list of tests, which must be carried out in the presence of the JEN inspectors, the applicant must submit the subsequent editions of the detailed
procedures (final) to JEN so that their technical services may evaluate same. As from the date of authorization of the pre-nuclear check, the applicant initially submits a quarterly review of the test timetable, and this is later submitted with greater frequency and he informs when the preceptive tests have to be carried out.

For each witnessed test, an official report is issued by the JEN inspectors, and for those which are not witnessed by the inspectors and "which may be carried out without the presence of official specialized personnel, an official record must be made of the tests carried out and the results obtained, which shall be signed by the permit holder and the representative of the Institute, Laboratory, Center or Body executing the work" (Art. 22). The results obtained are evaluated by means of an audit which emphasizes that the report of the results shall contain, at least:

- review of changes during the test
- review of deficiencies found
- review of results and approval or rejection of same
- review of quality assurance
- signature sheet.

4. NUCLEAR TESTS

Once the pre-nuclear tests are completed and all the relative results reports, both those prepared by the official representatives and those prepared by the permit holder, have been submitted to the Energy Administration Board and which state that the pre-nuclear check is completed, the licensee should request the provisional operation permit, submitting various documents. One of these documents is the Nuclear Test Program, which basically consists of:

- Organization manual of the start-up personnel (already submitted to the Administration when applying for the pre-nuclear check authorization).

- Nuclear test program and timetable, and

- Basic procedures (preliminary) of the nuclear tests.

The study and evaluation process used in this case is identical to that used for pre-nuclear study and evaluation. The Administrative manual revisions which have been edited are evaluated;
the list of nuclear tests is compared to those indicated in Appendix A of the Regulatory Guide 1.68 (November 1973), and the procedures are evaluated. When the evaluation period ends, the Nuclear Energy Board sends its preceptive report to the Energy Administration Board, which in turn issues - if appropriate and if all the documentation is complete - the Provisional Operation Permit, in which the nuclear tests to be carried out, among others, are indicated. These nuclear tests are preceptive, in other words, they must be carried out in the presence of inspectors from JEN, from the Provincial Delegation of the Ministry of Industry and from the Energy Administration Board (Art. 30).

In addition, as in the case of pre-nuclear tests, periodic meetings are held with the licensee to qualify doubts which may have arisen in the evaluation and to request additional documentation, if necessary.

It is more difficult to calculate the necessary effort in this nuclear phase as there is no temporary separation between the pre-nuclear and nuclear tests, but we can estimate a figure of 10-12 weeks x man.

In the same manner, "an official report summarizing the tests carried out and the results obtained will be prepared and signed by the permit holder and, if applicable, the official representatives and each one of the parties, can indicate in said report any statement they consider pertinent". (Art. 30).

During this phase, "the official representatives have the power to suspend execution of the tests at any time, when their continuation represents a potential danger, and the Energy Administration Board will be advised so that it may adopt the necessary measures". (Art. 30, paragraph 4).

When all the nuclear tests indicated in the nuclear test program have been completed and if all the test reports are complete and formalized and the results are correct - using Procedure C (Var 02-77, Rev. 2) to audit same - the start-up phase of the nuclear power plant will be considered as terminated and the operation phase will begin, with the owner/operator requesting a definite operation permit, and presenting various documents, which include amongst others "a) certificates and vouchers relative to the nuclear test program and the provisional operation". (Art. 31).
Independent of the official regulations, there is another rule which the applicants are obliged to fulfill and it is indicated in the different authorizations: preliminary construction, etc. In particular, each installation's preliminary authorization specifies that "the plant will be designed in accordance with the codes and national rules which are applicable. In addition, those guidelines established by international Organizations and adhered to by the Spanish Government will also be followed. For those cases not covered by the rules, codes or national and international guidelines, the codes and rules whose application is well-known in the nuclear industry will be applied. If it is not contrary to that stated above, the codes and rules established in the project's country of origin will be applied. By means of this obligation, foreign rules can be used in Spain and in particular, for the starting-up operation, they are basic documents for evaluating all those edited by the American NRC, such as the CFR Regulations, the Regulatory Guides applicable and the rules and codes such as the ASTM, ASME, ANS, IEEE, etc.

The start-up period of a nuclear power plant can last, on the average, from one year to a year and a half and, therefore, an approximate effort of 100-120 weeks x man must be made to evaluate the requests and inspections during the tests, according to the formalities indicated in Annex I.

5. **PRE-SERVICE INSPECTION**

Before starting up the nuclear power station it is necessary to specifically test that all the components and weldings in the pressure barrier meet the applicable standards for each case. This preliminary inspection, which is carried out by the application of non-destructive test techniques, is used as a reference inspection (fingerprint) in relation to future inspections to test that the status of the different components and weldings of the primary barrier does not deteriorate with use.

The basic documentation for drawing up an inspection program is referred to in the ASME Code, Section XI, in its various triennial revisions. As a result of the "reference plant" concept already mentioned, the Spanish nuclear power plants, which are of American design, in the pressure water or boiling water types, are obliged to follow the rules contained in Section XI of the ASME Code. Depending on the authorization dates (provisional operation permit), each plant is obliged to follow the
requisites contained in different editions, in other words, in certain units such as José Cabrera and Santa M. Garoña, edition 1971 was followed until the winter 1972 and summer 73 addendas, respectively. However, at the present time there is a tendency to utilize later revisions (in Garoña, now, the Edition covering 1974 to summer 1975 is used), which are not obligatory from a legal point of view, but which are of technical interest for obtaining greater safety and confidence in the installation in view of the high reliability level which the use of new revisions can represent over the old ones.

A similar case occurs in the plants under construction of Almaraz, Lemoniz, Ascó, and Cofrentes, where the Edition 1971 to winter 1973 is legally applicable, but as automated techniques are already being applied in Spain for non-destructive tests, the edition that the owners have voluntarily chosen is the 1974 to summer 1975 edition.

Preparation, execution and analysis of the results obtained during in-service inspection in nuclear power plants is normally carried out by companies in this field of non-destructive tests who have had to make considerable technical efforts to meet the strict requirements demanded by nuclear energy. In 1970, and in this regard, a company called TECNATOM, was created and established with capital from the seven largest electric companies in the Country, in order to have a technical back-up service to carry out specific jobs in the nuclear field. Within this private organization, there is a Special Techniques Department, which takes care of offering the preparation of in-service inspection programs. Therefore, the Spanish nuclear power plants which, in their majority, belong to the seven electric companies, contract preparation and execution of the in-service inspection work with TECNATOM who, in turn, usually sub-contracts it to other companies in the field (CIAT NUCLEAR, TECNICONTROL, BRENT IBERICA, KRAUTKRAMER FORSTER, etc.) to carry out the work under TECNATOM's supervision. TECNATOM also has technical assistance contracts signed with foreign firms or organizations such as NUCLEAR SERVICES INTERNATIONAL CO., SOUTHWEST RESEARCH INST. (SWRI) or UKAEA, which act as its advisors in non-destructive test problems or supply the necessary equipment.

Another important organization in carrying out in-service inspections is the Independent Inspection Agency. Although, during the construction phase, the mission of the Agency (which acts as a third party) is clearly defined (Section III, ASME Code), this is not so in that which refers to the requirements of Section XI of the ASME Code and this need for independent inspection is not completely defined in Spain.
With reference to the qualifications of the personnel who execute and supervise the non-destructive ISI tests, in the beginning they were established following the ASNT rules, as established in Section XI (Recommended Practice No. SNT-TC-1A) of the ASME Code, but as of 1971 the Non-Destructive Test Committee was created in Spain, within the Spanish Association for Quality Control (AECC) which forms part of the International Non-Destructive Test Committee; in 1973 this National Committee started publishing recommendations for personnel qualification and certification (END-F5, 1974 Rules), which are very similar to the ASNT Rules, they both employ the same I, II and III levels. The problems existing in this field refer to the preparation and qualification of the personnel in new techniques that evolve and to the different qualifications requisites existing between companies, and it occurs that personnel qualified and certified in accordance with the rules in a given country are not accepted - or accepted with drawbacks - in companies in other countries.

This last aspect could be solved if the International Committee would issue International Recommendations which would compile the most suitable rules in each member country and adopt them as their own, so that they could be used on an international level.

With reference to the teaching of quality control by means of non-destructive tests, we wish to point out that since 1975, theory-practice courses are being given in Spain in private companies and in the University, with about 200 hours duration.

There is a document called "Documentation to be sent to JEN in association with the in-service inspection of a LWR-type nuclear power plant", of which a copy is attached as Annex II, wherein the minimum estimated documentation required is indicated as well as the amount of advance time with which it must be sent to JEN so that their technical services can evaluate it, carry out inspections during the execution of the inspection work, audit the interested parties and inform the Energy Administration Board of the validity or ineffectiveness of the in-service inspection.

The estimated effort required during in-service inspections of a LWR-type nuclear power plant, on the average, is as follows:

<table>
<thead>
<tr>
<th>Description</th>
<th>Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>Evaluation of the ISI Program</td>
<td>1-2 weeks x man</td>
</tr>
<tr>
<td>Inspection during execution</td>
<td>2-3 &quot; &quot;</td>
</tr>
<tr>
<td>Evaluation of the ISI results</td>
<td>3-4 &quot; &quot;</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>6-9 weeks x man</strong></td>
</tr>
</tbody>
</table>
Bearing in mind that, at the present time, there are two plants with in-service inspection programs underway and two more carrying out pre-operational inspection, as mentioned above, the total average effort which must be applied is 12-18 weeks x man for the plants in operation and 20-30 weeks x man for those in the pre-operational phase, which results in the hypothesis that a pre-operational inspection represents 1.66 times greater effort than an in-service inspection.

Therefore, the true total effort for 1977 is calculated at about 40 weeks x man, which represents the work of a technician during an entire year (45 weeks x man). Actually, we do not have sufficient personnel and therefore this effort is not totally fulfilled.

Note: The results of the in-service inspections of the plants in operation are mentioned in the paper "Inspection during operation of a nuclear power plant in Spain".
b) DEFINITIVE OPERATION PERMIT

APPLICANT

TRIPlicate

PROVincIAL BRANCH
MINISTRY OF INDUSTRY

TEST CERTIFICATES AND
VouchERS

PROPOSALS OF MODIFI-
CATION OF MANDATORY
DOCUMENTS

INSPECTIONS

DIRECTor GENERAL FOR
ENERGY

NUCLEAR ENERGY BOARD

FINAL SAFETY
ASSESSMENT

DEFINITIVE OPERATION
PERMIT

LIMITS AND CONDITIONS

MANDATORY SAFETY DOCUMENTS
ANNEX II

JEN. DPTº. SEGURIDAD NUCLEAR
UNIDAD O. INSPECCION

DOCUMENTACION A REMITIR A LA JUNTA DE ENERGIA NUCLEAR ASOCIADA
A LA INSPECCION EN SERVICIO (IES) DE UNA CENTRAL NUCLEAR TIPO
LWR

Madrid, 1 de Junio de 1977
1. PRESENTACIÓN

Con objeto de normalizar la documentación a remitir a la JEN para la vigilancia y control por el Departamento de Seguridad Nuclear de las inspecciones en servicio (IES), tanto las programadas en los periodos de recarga de una Central Nuclear como las programadas en otros periodos del ciclo de funcionamiento, se señala a continuación la documentación mínima estimada necesaria y la antelación con que debe ser remitida.

2. ESPECIFICACIONES

2.1. IES realizada durante una parada de recarga

Este tipo de inspecciones en servicio está contemplado en el Código ASME, Sección XI, tanto en la edición de 1971 como en la de 1974, con sus respectivas addendas.

Las IES se han de realizar periódicamente, cada 10 años, durante la vida de la central nuclear y a partir de la fecha de operación comercial de la misma, con un calendario que se adapte a alguna de las tres posibilidades que se muestran en el anexo 1 y salvando las excepciones que el Código indica, se realizará entre el 25% y el 33,3% de su extensión en el primer periodo, entre el 50% y el 66,6% en el segundo y el resto, o sea, hasta llegar al 100% de IES, en el tercero.

En relación con cada inspección se deberá:

a) DOS MESES, como mínimo, antes de la fecha prevista de parada para recarga, se remitirá la Revisión 0 de la "Especificación de trabajos de IES a realizar", incluyendo un Índice que contenga:

- Alcance: Item y categoría ASME aplicable.
  Tipo y número de componentes a examinar.
  Métodos de ensayo.
- Códigos aplicables según el método de inspección.
- Agencia de Inspección que realizará los ensayos.
- Agencia de Inspección Independiente seleccionada.
- Procedimientos básicos de inspección, según el método a emplear.
- Contenido básico del informe final de inspección.
- Estimación de dosis al personal.
- Referencia al acta del Comité de Seguridad del Explotador donde conste se haya discutido y aprobado el programa de IES, así como la transcripción de las conclusiones a que llegase el Comité.
b) **DOS SEMANAS**, como mínimo, antes de la fecha prevista de parada para recarga, se remitirá la **Revisión final** de la "Especificación de trabajo de IES a realizar", acompañada de los siguientes documentos:

- Identificación de sistemas, componentes, equipos y soldaduras a revisar; categoría y método de inspección aplicables en cada caso; tipo de material base.

- Procedimientos de soldadura de construcción y/o posibles reparaciones posteriores junto con las correspondientes homologaciones de procedimientos y soldadores (sólo para la IES del primer intervalo).

- Procedimientos y resultados de END previamente realizados (en particular, BASELINE o FINGER PRINT Inspection).

- Métodos de inspección: procedimientos detallados, según la Sección aplicable del Código ASME (en particular, la Sección V).

- Planos y diagramas complementarios de cada sistema, componente, equipo o soldadura (isométricos, planos de construcción, etc).

- Cualificaciones, en cada método, del personal examinador y supervisor, incluida la Agencia de Inspección Independiente, según la Norma SNT-TC-1A de la ASNT.

- Situación de los trabajos de IES dentro del programa general de la parada de recarga (camino crítico).

- Previsiones detalladas dosimétricas (planos con los niveles radiológicos en las zonas a inspeccionar, dosis al personal examinador y supervisor e historial dosimétrico previo de dicho personal).

c) **DURANTE** la realización de la IES, se facilitarán las sucesivas revisiones, si las hubiere, de cualquier documento de la misma.

d) **FINALIZADA** la IES y siempre con, al menos, **48 horas de anticipación** al inicio del arranque de la central, se remitirá un "Informe PRELIMINAR de resultados de IES", el cual debe contener:

- Sistemas, componentes, equipos y soldaduras realmente examinados; códigos aplicados.

- Resultados de la IES efectuada.
e) TRES MESES, como máximo, después de la fecha de finalización de la parada de recarga, se remitirá el "Informe FINAL de resultados de IES", cuyo contenido debe ser, como mínimo:

- Alcance final de la IES (Identificación de componentes, sistemas, equipos y soldaduras realmente examinados).

- Métodos de END aplicados; procedimientos aplicados (revisión final); especificaciones y Códigos utilizados.

- Fechas de realización de la IES, personal examinador y supervisor y Agencia de Inspección Independiente; homologaciones no enviadas con el documento "Especificación de trabajos de IES a realizar", de acuerdo con la Norma SNT-TC-1A (última revisión) del ASNT y apéndices de la misma.

- Equipos y materiales de END utilizados, junto con los certificados de homologación pertinentes.

- Análisis final de los resultados obtenidos.

- Referencia al acta del Comité de Seguridad del Explotador don de conste se hayan discutido y aprobado los resultados de IES, así como la transcripción de las conclusiones a que llegase el Comité.

Como ANEXOS al Informe FINAL se acompañarán:

- Hojas de calibración de equipos y materiales utilizados.
- Hojas de registro de indicaciones obtenidas con cada método empleado.
- Historiales dosimétricos finales del personal que intervino en la IES.
- Planos, esquemas, diagramas, fotografías y otros registros complementarios que sean necesarios.
- Los documentos, según proceda, vendrán avalados con la: Fecha y firmas del Director de la Agencia encargada de la realización de la IES, del de la Agencia de Inspección Independiente y del de la compañía propietaria de la central nuclear inspeccionada.

2.2. IES realizada fuera de la parada de recarga

Normalmente este tipo de IES se realiza por una necesidad perentoria de comprobación del correcto funcionamiento de algún sistema, componente, equipo o soldadura de los que se haya comprobado alguna posibilidad de fallo inminente.
Por tanto, la programación tendrá como fecha de partida aquella en que, después de analizar los efectos y consecuencias, se decidiera por parte de la compañía propietaria de la central afectada o por parte de la Administración (DGE), la necesidad de realizar una IES en el sistema, componente, equipo o soldadura afectados. Asimismo, y debido al efecto de presentoriedad ya indicado el tiempo de presentación de documentos será:

a) Dentro de las **DOS SEMANAS** siguientes a la fecha de decisión para la realización de la IES, se enviará la documentación indicada en el apartado 2.1.a. antedicho.

b) Al menos con **UNA SEMANA** de antelación a la fecha prevista de parada programada para la realización de la IES, se remitirá la documentación señalada en el apartado 2.1.b, exceptuando la situación de los trabajos de IES dentro del camino crítico de la parada, la cual será sustituida por una programación de la IES en la parada programada.

En cuanto a los apartados 2.1.c, 2.1.d, y 2.1.e anteriores se mantienen en este caso, tanto las fechas de presentación de documentos como el tipo y contenido de los informes descritos en dichos apartados.

2.3. **IES que motiva una reparación**

Si como consecuencia de la evaluación de algún o algunos defectos en sistemas, componentes, equipos o soldaduras, según lo indicado en el Código ASME, Secciones III y XI, y sus posteriores addendas, se encuentra que las indicaciones son relevantes y están por encima de los máximos admisibles, será necesario hacer una reparación en los sistemas, componentes, equipos o soldaduras afectadas.

Una vez decidida la reparación, como resultado o conclusión final de la evaluación hecha por la compañía propietaria de la Central, teniendo en cuenta las recomendaciones de:

- la empresa encargada de la IES (Agencia de inspección),
- la Agencia de Inspección Independiente,
- el suministrador principal del sistema afectado,
- la empresa encargada de la reparación, si existe, y
- el Comité de Seguridad Nuclear del Explotador de la central,

se preparará un conjunto de documentos que contendrán la siguiente información, como mínimo, y que estarán disponibles en el archivo de la central:
Identificación del sistema, componente, equipo o soldadura afectados; planos de construcción y diagramas complementarios (isométrico...); tipos de material (base de aporte...)

Procedimientos de soldadura y características del metal base y de aporte a emplear en la reparación, junto con las correspondientes homologaciones de procedimientos y soldadores.

Procedimientos de corte de tuberías, y tapado de las mismas, en su caso.

Procedimientos de END a realizar antes, durante y después de la reparación, incluidas las pruebas hidrostáticas, junto con las homologaciones del personal de IES y la Agencia de Inspección Independiente involucradas, según la Norma SNT-TC-1A de la ASNT.

Estimaciones de dosis radiológicas al personal de reparación y de END, en las zonas a reparar.

Una vez terminada la reparación e inspeccionada posteriormente, se añadirá a los anteriores documentos un "Informe Final de la reparación efectuada", el cual contendrá, al menos, lo siguiente y será enviado TRES MESES, como máximo, después de la fecha de finalización de la reparación:

- Alcance de la reparación (identificación final del sistema, componente, equipo o soldadura afectado).

- Métodos de reparación empleados; procedimientos de corte, de soldadura empleados y sus correspondientes homologaciones de procedimientos y personal; especificaciones y códigos aplicados.

- Métodos de END empleados; procedimientos de ensayo utilizados y sus correspondientes homologaciones de procedimientos y personal; especificaciones y códigos aplicados.

- Materiales y equipos utilizados, tanto en la reparación como en la inspección por END, y los certificados de homologación pertinentes.

- Análisis final de los resultados obtenidos; referencia al acta del Comité de Seguridad del Explotador donde conste se hayan discutido y aprobado los resultados de la reparación, así como la transcripción de las conclusiones a que llegase el Comité.
Como ANEXOS al Informe FINAL se acompañarán:

- Hojas de registro de indicaciones obtenidas con cada método de END empleado.
- Historiales finales dosimétricos del personal de reparación y de inspección por END.
- Planos, esquemas, diagramas, fotografías y otros registros complementarios que sean necesarios.
- Los documentos, según proceda, vendrán avalados con la:
- Fecha y firmas del Director de la empresa encargada de la reparación (si la hubiere), de la Agencia de inspección por END, del de la Agencia de Inspección Independiente y del de la compañía propietaria de la central nuclear.
FIG. 1.- INSPECTION PROGRAM—A EXAMINATION PER PLANT OUTAGES (1WB2410)
ASME XI—ED. 1971 AND 1974 (TILL ADD. W-75)

FIG. 2.—INSPECTION PROGRAM—A EXAMINATIONS PER PLANT OUTAGES (IWA 2410)
ASME XI—ED. 1974, ADD. W-75

FIG. 3.—INSPECTION PROGRAM—B EXAMINATIONS PER PLANT OUTAGES (IWA 2420)
ASME XI—ED. 1974, ADD. W-75

ANEXO
PRACTICAL EXPERIENCE AND PROBLEMS IN THE INSPECTION WORK DURING TEST AND ROUTINE OPERATION OF NUCLEAR POWER PLANTS

Thomas Backström
Swedish Nuclear Power Inspectorate
Stockholm (Sweden)

In this paper a brief description is given of the Swedish Nuclear Power Inspectorate (SNPI) and its working methods in the field of licensing procedures and inspection activities. SNPI has introduced a system to be kept continuously informed about the operation of the nuclear power plants. This information is used in the preparation work preceding the inspections. Experience obtained from the inspection activities show that inspection frequency has been lower than planned, documentation can be improved and that good relations between the authority and the utilities, including the operating personnel, is to the benefit of the nuclear safety.
1. INTRODUCTION

During 1976 five nuclear power stations were in operation and supplied almost 20% of Sweden's electric output. During 1977 one station will be taken into operation and during 1978 two more. Two plants will at that time be in the final stage of construction. This rapid development of the nuclear program and the development of the safety criteria during the last years has led to an increase in the number of Swedish Nuclear Power Inspectorate (SNPI) staff directly involved in inspection of nuclear power plants from five to about twenty in three years. (Total number of SNPI staff, including departments of safeguards, waste management, research, administration and management is about 40).

2. ORGANISATION AND RESPONSIBILITIES OF THE DEPARTMENTS INVOLVED IN INSPECTION ACTIVITIES

The direct inspection work is carried out by the department of inspection and the department of technical support.

2.1 Department of inspection

The department of inspection is responsible for review and inspection of nuclear power plants. The department is also responsible for handling contacts with the utilities in all matters directly concerning a nuclear power project and for making sure that established regulations for the construction and operation of nuclear power plants are followed. The department also participates in the processing of permit applications.

The department of inspection is divided into site responsible sections headed by a site responsible inspector. This means that one inspector is responsible for several units and at one site (Ringhals) for both pressurized water reactors and boiling water reactors.
2.2 Department of technical support

The department of technical support is responsible for the technical review of safety matters and for the development and application of safety standards. The department evaluates the utilities' reports of safety-related incidents and examines and issues regulations for construction and operation. The department also participates in the processing of permit applications.

3. SUPERVISION DURING COMMISSIONING AND ROUTINE OPERATION

The SNPI is kept informed of the operation of the nuclear power plants during the start-up procedure and during routine operation by the reporting system and by frequent inspections.

3.1 Reporting system

The utilities are obliged each day to report operational events during the last 24 hours. A special form (figure 1) for these daily reports has been introduced by SNPI to get comparable information from the different utilities. The information received from these daily reports is

- day of the report
- operation during the day
  - thermal power levels
  - generator power levels
  - net electrical output (MWh)
  - average power (MWe)
- abnormal occurrences
- reportable events
- disturbances (for example reactor trips)
- others (maintenance, tests, power reductions etc.).

As a complement to these daily reports all safety related occurrences and all reactor trips are reported to SNPI more in detail on special forms within time limits specified in the Technical Specifications. (These reports will be presented in another paper during the Specialist meeting).

3.2 Inspections

The SNPI distinguish between two kinds of inspections - special inspection and routine inspection. Our reporting system makes a good base for planning and performing inspections of both types.
3.2.1 **Special inspections**

A special inspection is called for by operational events such as abnormal occurrences and when SNPI finds it necessary to thoroughly investigate certain problems, systems, components, phenomenon, tests etc. The duration of a special inspection and the manning of the inspection group is determined at each occasion depending on subject of the inspection.

3.2.2 **Routine inspection**

Routine inspections are mainly meant for controlling the observance of the Technical Specifications. The routine inspections are regularly recurrent and are not directed by operational events which could be the case with the special inspections.

Planned routine inspection frequency is

- during commissioning - twice a month
- during routine operation - once a month.

The duration of a routine inspection is one to two days and is carried out by one or two inspectors.

According to our plans a routine inspection should comprise the following items:

(a) Operation since last inspection

The inspector shall review operational results, maintenance, records etc.

(b) Operational events since last inspection - both reported and unreported.

When reviewing incidents investigations shall be made to verify that all the problems which might have caused the incidents have been explained and that corrective measures have been taken. Furthermore shall be investigated whether discovered deficiencies require changes in systems, components and operating or maintenance instructions.

(c) Periodical tests

Results of periodical tests according to the Technical Specifications, pressure vessel codes etc. shall be reviewed. Investigations shall be made to verify if the experience of the tests requires changes in systems, components, instructions etc.
(d) Certain review

A more detailed review of systems, components, routines, functions phenomenon etc shall be made in such a way that safety related parts of the station will be reviewed about once every one and a half year.

(e) Current operation

When reviewing the current operation possible deviations from normal operation shall be investigated as well as if any maintenance criteria (according to the Technical Specifications) are used and if any other maintenance work is going on. Routines for maintenance and repair permits, locking, preservation of separation etc. shall be reviewed.

(f) Tour of the station

This tour is made to verify the conditions according to item (e) above.

3.2.3 Inspection report

After each inspection an internal inspection report shall be written. The utility is informed verbally during the inspection and/or by letter afterwards if the SNFI should find deficiencies demanding corrective measures.

4. PRACTICAL EXPERIENCE AND PROBLEMS IN THE INSPECTION ACTIVITIES

4.1 Commissioning

The purpose of the inspections during the early phase of test operation is to become familiar with the station and the operating staff. As the test operation is progressing the purpose of the inspections change from an acquaintance procedure to checking that testing is conducted in accordance with approval procedures.

The planned inspection frequency during the commissioning phase - twice a month - has not been obtained. The average inspection frequency has in fact been less than once a month. The reason why the planned inspection frequency not has been obtained is partly to be found in the fact that the staff of the SNFI have dual functions as inspectors and as reviewers participating in the licensing procedure.
The precritical tests are done coincident with the final part of the licensing procedure, which makes it difficult for the SNPI staff to perform the inspections in the extent planned. This fact has been obvious for some time and a debate concerning resident - non resident inspectors has taken place. The conclusion of this debate was that the SNPI shall not have resident inspectors due to the apprehension that the site resident inspector in due time would become more a part of the retility body instead of a part of the authority body. The utilities have expressed a desire to have the SNPI to overlook the test operation as much as practically achievable. The SNPI has then together with the utilities chosen those tests upon which the authority is to be present. Some of these tests have been inspected by SNPI inspectors. On other tests consultants have been used to represent the SNPI. The use of consultants in this field has come out very well. To guide the consultants how to overlook the tests, we have used the USNRC Branch Technical Positions (BTP) with an addendum containing the applicability of the BTP on the station concerned and operational experience of the systems involved in the tests.

Nor during the nuclear test operation has the inspection frequency been as high as desirable. During this phase the power levels are increased in stages and various tests are performed in each stage according to approved procedures. The results of the tests are compiled at the end of each stage and are presented to the SNPI for examination before permission for the next stage can be obtained. The first examination is made to verify that there are no obstacles to continued test operation. After that the tests are thoroughly reviewed and points to be solved are listed. This examination is made by the site responsible inspector. This is the reason behind the low inspection frequency.

4.2 Routine operation

When the specified tests have been carried out with satisfactory results and when all prescribed reports have been examined and when any remaining questions have been answered satisfactorily, the SNPI can grant permission for routine operation.

Inspections of stations in routine operation have been effected in greater extent, compared to the plans, than the inspections of stations during test operation, although without obtaining the planned frequency of once a month.

The problem in all kind of inspection work is to identify whether given rules are observed or not. This problem is accentuated in complex plants like the nuclear ones with a variety of rules and regulations, especially as the SNPI, as
I suppose many other authorities, is suffering from a lack of personnel with operating experience of power plants. Frequent inspections will in due time give an inspector understanding of operation of a station, but this understanding can not compensate for the experience of having operated a station.

The inspection plan in paragraph 3.2 above is meant to be a guide to the inspector on duty and not as a law. We believe that inspections will become more effective if they are not all alike because the utilities will then not know what special subjects to be brought up.

There are no instructions of the content of an inspection report. As our inspections are carried out differently at each occasion the content of the inspection reports also becomes different from time to time. Information given in the reports from inspections of different stations is not comparable. This must be improved and work is going on to standardize the inspection reports.

To create good relations to the operating staff and carefully listen to their opinion on different matters, we have experienced as very valuable. As an example of the value of the discussions with the operating staff there is one case where the utility, after the SNPI had made topical some questions discussed with the operating staff, made a reorganisation of the maintenance group and of the control of holding of spare parts. Furthermore this discussion led to a speed-up of an extensive program for rebuilding parts of the station.

Although we have established good relations to the operating personnel, in one of the utilities a conflict between the staff and the management arose last August without our knowledge of the complaints pointed out by the staff. The staff shut down the reactor pointing out that they could not take the responsibility to continue to operate the reactor in a safety manner with the staff in charge. They claimed that the number of staff in each shift was too low and that the education of the staff was defective. After negotiations with the SNPI the operation was resumed and an investigation concerning the number of staff on each shift and their education was to be completed within three weeks. The outcome of the investigation was that the minimum number of controlroom staff have to be increased from five to seven and that an extensive education program shall be carried out during the fall of this year. The problem of the SNPI in questions like this one is that there exists no formal licensing of operators in Sweden. The plant owner is responsible for ensuring that newly recruited personnel receive adequate training for their duties and that satisfactory level of competence is maintained within the organisation. The SNPI is kept informed of the holders of some important positions within the operational organization.
A work is now going on aiming at an introduction of a licensing procedure of operational staff within two years.

5. CONCLUSIONS

A high safety ambition means that the safety tests carried out by authorities on a nuclear power plant must be a continuous process throughout the entire operational life of the plant. Attention must constantly be devoted to demanding changes as result of experience obtained from operation, testing, new regulations in other countries or new research results. Part of the experience from operation and testing is obtained from the inspection activities. In Sweden the inspection work therefore is considered very important and efforts are made to improve the inspection activities and thereby the safety of the nuclear power plants.
# Daily Report

**Power Station**

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Figure 1. Daily Report
SPECIFIC PROBLEMS AND PRACTICAL EXPERIENCE OF REGULATORY
INSPECTION DURING COMMISSIONING IN THE UNITED KINGDOM

G Lewis
Health and Safety Executive
Nuclear Installations Inspectorate
United Kingdom

The commissioning of nine Magnox and two Advanced Gas-cooled Reactor Nuclear Power Plants in the United Kingdom during the last sixteen years under the regulatory control of the Nuclear Installations Inspectorate of the Health and Safety Executive has been based on a Stage Approval Philosophy starting with proof-testing of the primary gas circuit and concluding with tests on the reactor at full power. The practical experience gained during this period has enabled the Nuclear Installations Inspectorate to rationalise the procedures and test requirements without compromising safety standards. The Operating Rules and Maintenance Schedules are approved for commissioning and during this period are reviewed for their adequacy for future power operation of the plant. The organisation, documentation, test procedures and the commissioning programme used for the Advanced Gas-cooled Reactors are briefly explained.
1. **INTRODUCTION**

The regulatory inspection activities on Nuclear Power Plant sites under construction in the United Kingdom has already been described in a paper presented at this conference [1] which included the general aspects of site inspection, quality assurance requirements and certain inspection activities on the licensed site and at the manufacturers' works, and the preparations leading up to the commissioning of the reactors.

This paper covers the organisation, management, documentation, test procedures and regulatory requirements which have been evolved in the UK during the past 16 years on the commissioning of NPPs and, particularly, as applied to the Advanced Gas-cooled Reactors (AGRs) currently being constructed and commissioned. These NPPs have an installed capacity of 1320 MW(e) and have twin reactors, each reactor associated with a single 660 MW(e) Turbo Alternator. The commissioning programme described in this paper indicates the increasing safety requirements and operating conditions as the reactor proceeds to full power.

Extracts from the AGR commissioning programmes and Figure 1 which shows a cross-sectional arrangement of the reactor, are reproduced with the permission of the Electricity Generating Boards in the UK.

2. **ORGANISATION AND MANAGEMENT FOR COMMISSIONING**

The arrangements for the commissioning of the NPP are submitted by the Licensees for approval by the NII, each reactor and associated auxiliary plant having a separate commissioning programme.

2.1 **Station Commissioning Committee**

The Station Commissioning Committee (SCC) is responsible for the organisation and management of the resources and personnel for the purpose of commissioning the station. The Chairman is the Station Manager and other members include representatives from the Licensee's Design, Construction, Research and Development, Nuclear Safety and Operations departments together with representatives from the Nuclear Plant Design Company and plant manufacturers.

The terms of reference of the SCC are to prepare the Commissioning Programme (CP), formulate the principles to be adopted for all plant system testing, and organise the resources to complete the work to a time schedule. The Commissioning Test Schedules, which are produced by the Nuclear Plant Design Company, are approved by the SCC before being implemented and the Commissioning Test Reports are endorsed by the SCC and submitted as evidence that the tests have been completed satisfactorily before submission to the NII.

2.2 **Independent Consultants**

Independent specialists are appointed by the Licensees to approve the construction and commissioning of the Concrete Pressure Vessels (CPVs) which house the reactor and integral boilers in a common pressure containment. One of the specialists, the "Appointed Engineer", is primarily responsible for all aspects of the inspection associated with the CPV which includes the foundations, steel reinforcement and load tendons. The
Appointed Engineer reports to the NII on any deficiencies and the results of the inspection.

The inspection and assessment of the steel liner of the CPV, and all the steel components forming the internal structure of the reactor and the boilers, is carried out by independent insurance company surveyors appointed by the Licensees. Their inspection findings are made available to the NII throughout the construction period and on completion of the proof pressure testing, certify that the CPV is satisfactory for fuel loading.

2.3 **NII Regulatory Inspection**

The site inspector appointed during the construction period of the NPP to cover all the general aspects of regulatory inspection is supplemented by additional inspectors from the design assessment branch of the NII during the period of commissioning. These specialist inspectors will have already been involved with the design assessment of the plant covering such aspects as:

(a) Reactor physics and fault studies  
(b) Health physics, shielding and radioactive waste  
(c) Electrical engineering  
(d) Mechanical engineering  
(e) Control and instrumentation  
(f) Quality assurance.

The site inspector co-ordinates the activities of these specialists to meet the commissioning programme requirements, and he is also responsible for ensuring the correct and expeditious processing of all documentation through the NII so that unnecessary delays are avoided. Specialist inspectors will be involved with other stations at the same time and priorities must be clearly defined within the NII.

3. **DOCUMENTATION**

The control which is exercised by the SCC is based on documentation and approved procedures. The documentation also provides a history of events and a concise record of base line parameters for all the plant tested which can be used as a basis for comparison of the safety performance throughout the life of the plant. Other documentation concerned with the safety control of the plant is also described.

3.1 **Commissioning Programme**

The Commissioning Programme (CP) is divided into separate stages which reflect the increasing safety requirements and provides suitable periods for the review of the test results and the safety of the plant and should contain the following information:

(a) Commissioning stage and operation number  
(b) Test title and OTS reference number  
(c) Estimated duration of test  
(d) Approximate reactor conditions (reactor power, coolant pressure, temperature, flow)  
(e) Mandatory operating limits and NII inspection requirements  
(f) Special conditions or limitations for any test.
The CP should indicate where formal approval is required to proceed, and include the reactor trip parameters and operating rule suspensions required in each stage.

3.2 Commissioning Test Schedules

The Commissioning Test Schedules (CTSs) consist of:-

(a) Introduction (description of plant)
(b) Objects of test
(c) Method of testing
(d) Predicted results
(e) Responsibilities
(f) Safety requirements (Electrical/Mechanical/Radiological)
(g) Tables, figures and references.

3.3 Commissioning Test Reports

Commissioning Test Reports (CTRs) are produced for all tests and give the following information:-

(a) Introduction (plant state)
(b) Dates and method of testing
(c) Results
(d) Conclusions
(e) Reservations
(f) Tables, figures and references.

3.4 Stage Completion Certificate

The Stage Completion Certificate is issued by the Station Manager as evidence that all appropriate tests have been completed and it is considered safe to proceed to the next stage. Any tests, or parts of tests not completed in accordance with the CP must be described together with the reasons for these exceptions. The Stage Completion Certificate must be submitted to the NII before approval to proceed can be given.

3.5 Regulatory Inspection Reports

The Regulatory Inspection Reports, or Visit Reports, are produced by the site or specialist inspectors following a visit to the NPP. These reports give details of the period of the visit, commissioning tests in progress during the visit, plant conditions and results of tests, any defects or non-compliance with the statutory requirements, and action taken in respect of such matters. Follow-up action is taken from previous visits and outstanding matters are reviewed periodically.

3.6 Operating Rules and Plant Operating Instructions

Operating Rules (ORs) are produced by the Licensee and approved by the NII for application during commissioning. They are based on the design parameters and safety reports and lay down statutory safety operating limits and auxiliary plant availability required to maintain a reactor in a safe condition whether it is shut down or at power.
The ORs cover such matters as:-

(a) Reactor structural and fuel cladding operating temperature limits
(b) Reactor coolant pressure, temperature and purity limits
(c) The availability of auxiliary plant to ensure the reactor heat removal requirements are adequate
(d) That emergency generators are available in the event of loss of normal electrical supplies
(e) The fuel integrity is monitored continuously at power so that in the event of cladding failure, the defective fuel can be safely discharged.
(f) Adequate instrumentation and communications are available for the control of the NPP at all times.

The Plant Operating Instructions (POIs) which implement the ORs are submitted to the NII and any amendments are notified within 14 days of their implementation. Some ORs may need to be temporarily suspended during commissioning tests and all ORs are subject to reappraisal during, or following, the completion of commissioning.

3.7 Maintenance Schedule and Instructions

The Licensee is required to prepare a Maintenance Schedule (MS) which is a list of safety related plant and equipment, specifying the methods to be employed for inspection, testing and maintenance, and indicating the periods between these activities. The MS is approved by the NII and becomes effective from the commencement of commissioning.

The methods to be used to carry out inspection, testing and maintenance are described in the Maintenance Instructions (MIs) and these are used to implement the MS and are verified during the commissioning period where appropriate.

The first statutory inspection of the reactor is completed one year from the date of its initial power raising (Stage III). Subsequent reactor inspections are scheduled to be undertaken biennially but this period may need to be reviewed.

3.8 Directions, Consents and Approvals

These are formal documents issued by the NII on behalf of the Health and Safety Executive (HSE) directing the Licensee to comply with statutory requirements and consenting to, or approving, proposals submitted by the Licensee under the Licence Conditions. These documents are prepared by the NII with advice from the HSE legal advisors before being issued.

3.9 Consultant Certificates

These certificates are completed by the Appointed Engineer and independent insurance company surveyor and are submitted by the Licensee to the NII before initial fuel loading. If modifications are found to be necessary during commissioning, further certificates will be required at other stage approval points. These, together with other construction and commissioning records, form part of the case history of the CFVs and
are kept up-to-date and available for inspection on the licensed site.

3.10 Approved Drawings

Drawings of plant and equipment designated by the NII during the design assessment period as having significant safety implications must be submitted for approval before commissioning. The drawings must be certified as representing the installed state of the plant or equipment and any modifications found to be necessary during testing are marked up on the station master-copy of the approved drawings and, on completion of commissioning, are resubmitted for final approval. Regulatory inspections should verify that the plant so designated is correct to the drawings.

3.11 Emergency Plan and Instructions

Whilst the possibility of an accident at a NPP leading to a release of significant quantities of radioactive materials is extremely unlikely, especially with CFW reactors, nevertheless the NII require the Licensees to prepare an Emergency Plan (EP) to safeguard the general public and personnel on the NPP in case of such an eventuality. The EP is approved by the NII and is implemented by detailed Emergency Instructions which describe procedures for:-

(a) The safe evacuation of personnel from the vicinity of the accident to pre-arranged assembly areas
(b) The immediate establishment of an emergency control centre to control and co-ordinate the emergency procedures
(c) The assembly and deployment of trained environmental monitoring teams to determine the extent of the radioactive release
(d) The mobilisation of specialist teams on the station to carry out fire fighting, first-aid and rescue, and emergency plant repairs to ameliorate the consequence of the accident
(e) The notification of all local and national organisations to assist in the protection of the population as is considered necessary.

The Licensee is required to show the effectiveness of the emergency arrangements before initial fuel loading (Stage II) by postulating an accident to the plant and initiating these emergency procedures. The demonstration is witnessed by NII observers. Subsequent emergency exercises are held to such an extent and at such times as the NII may direct.

4. COMMISSIONING PROCEDURES

To ensure that the NII safety requirements are implemented during commissioning, the following procedures have been adopted.

4.1 Plant Testing

The Commissioning Programme (CP) which schedules all plant testing is submitted to the NII to enable the regulatory requirements for each test to be indicated, and for the inclusion of any additional tests
which may be considered necessary in the interests of safety. Tests are classified in the following manner:

A - Tests to be witnessed by NII inspectors
B - CTRs required for stage approval
C - CTRs to be submitted for assessment
D - CTR which may be examined at site.

It is the responsibility of the Licensee to advise the NII, in writing, when Category A tests are scheduled to take place. The presence of an inspector to witness a test is not made mandatory.

4.2 Assessment of Commissioning Test Reports

All Category B Commissioning Test Reports (CTRs) are submitted to the NII for independent assessment, for comparison with the predictions of the Commissioning Test Schedules (CTSs) and in the design safety reports before stage approval is given. The NII exercises close supervision of the commissioning programme and this enables preliminary test results to be accepted for stage approval in advance of the final commissioning report so that the programme is not unnecessarily delayed.

4.3 Authorised Plant Operators

The Station Manager is responsible for the safety of the plant and personnel during commissioning in accordance with the Licensee's Safety Rules. The Licence Conditions require that the plant must be operated under the control and supervision of Duly Authorised Persons (DAPs). These are appointed by the Licensees and approved by the NII.

During commissioning, DAPs carry out all operational functions under the guidance of the Nuclear Plant Design Company. All operations must be carried out in accordance with ORs and POIs and these activities are recorded in plant logs and test schedules and are made available for examination by the regulatory inspectors. Appropriate plant records are preserved for specified periods as approved by the NII.

All plant inspection, testing and maintenance is supervised by DAPs in accordance with the Maintenance Schedule and Instructions and they must certify that these activities have been completed satisfactorily.

4.4 Plant Modification Procedure

In order to maintain the required standards of safety at NPPs, no alteration, addition, modification, repair or replacement affecting nuclear safety may be made to any part of the plant until an appropriate safety assessment has been completed and agreed in accordance with the Plant Modification Procedure (PMP). The PMP is produced by the Licensee and approved by the NII and should be introduced during the commissioning period. Proposed modifications are prepared by the Nuclear Plant Design Company and submitted to the SCC for their endorsement before implementation. Certain modifications of major significance and specifically those affecting plant and equipment on Approved Drawings must be agreed by the NII before implementation and modifications of a minor safety category are reported to the SCC retrospectively.
4.5 Reporting of Incidents or Defects

The Licensee is required to report immediately any incidents or defects which could affect the safety of the NPP. This requirement is particularly important when the plant is first set to work and a detailed report is required on completion of the enquiry into any such incident or defect. Also during the period of commissioning, a report is required to be submitted to the NII on all unscheduled reactor trips caused by plant defects, equipment faults, or operator errors.

4.6 Commissioning Progress Meetings

During the commissioning programme, at the discretion of the NII, meetings are arranged with the Licensees, at which specialists are available, to discuss the general progress of the commissioning programme, plant modifications, reported incidents and other matters arising from the assessment of commissioning documentation. Such meetings can be a more effective method of rationalising procedural difficulties which may arise and also for obtaining additional information more expeditiously. Formal notes of these meetings are kept, and any proposed action to be taken is recorded.

5. COMMISSIONING PROGRAMME

The Commissioning Programme being used for the first AGR plants is summarised below, to illustrate the stage approval philosophy for regulatory control. The plant system tests completed in each stage are listed and the NII test categories assigned, as described in Section 4 of this paper, are given. Typical reactor operating limits for each stage are also given.

The periods estimated to complete each stage were substantially increased due to plant defects. Considerable modifications to plant and fuel assemblies were necessary with extensive retesting.

Stage I - Reactor system tests before fuel loading

1. CPV proof pressure and leak rate tests (A)(B)
2. Reactor safety circuit and guard line tests (A)(B)
3. Control rod electrical system and mechanism tests (A)(B)
4. Essential auxiliary plant tests (A)(B)
5. Combined gas circulator tests (B)
6. CPV thermal insulation tests (B)
7. CPV cooling water system tests (B)
8. Burst cartridge detection system tests (B)
9. Reactor secondary shutdown system tests (A)(B)
10. Reactor data processing system tests (B)
11. Nuclear matter storage and handling facility tests (A)(B)

Limiting Operating Conditions

Gas pressure ........................................ 45.5 Kg/cm²
Mass flow ............................................ 100% (3850 Kg/sec)
Reactor gas temperature ......................... 300°C
The stage is concluded with an internal inspection of the CPV by the Licensee and NII inspectors.

Before approval is given to proceed to Stage II, a demonstration of the Station Emergency Arrangements is witnessed by NII observers.

Stage II - Initial fuel loading, physics measurements and reactor system tests without nuclear heating

1. Fuel loading to full size core (B)
2. Reactor physics measurements (A)(B)
   (a) Built in reactivity of initial fuel charge
   (b) Control rod worths and reactivity release rates
   (c) Axial and radial flux measurements
   (d) Local criticality tests
3. Combined gas circulator tests (B)
4. Reactor internal gas baffle overpressure tests (B)
5. Neutron flux measuring equipment tests (B)
6. Fuel handling equipment tests (A)(B)
7. Fuel assembly variable flow gage tests (B)
8. Decay heat loop system tests (B)
9. Reactor trip tests (A)(B)
10. Essential supply system tests (A)(B).

The reactor physics measurements are completed in air using pressure balancing techniques with the reactor critical. Doubling time measurements are completed with reactor power levels not exceeding 1 MW(Th). Dynamic testing of the fuel assemblies and the reactor internal structure using CO2 at design density at 300°C and maximum coolant flow rates, is completed with the reactor shut down.

The stage is concluded by a final internal inspection of the reactor by the Licensee and NII inspectors before the fuel is irradiated.

Stage III - Initial power raising to 20% design output

1. Raise reactor power progressively to 20% power (A)(B)
2. CPV structure temperature surveys (B)
3. Health physics and shielding measurements (B)
4. CPV thermal insulation tests (B)
5. CPV cooling water system tests (B)
6. Control rod freedom of movement tests (B)
7. Boiler and feed system tests (B)
8. Start up and steam dumping system tests (B)
9. Commission of main turbo alternator (B)
10. Channel gas outlet temperature survey and gage adjustment (B)
11. Fuel cladding integrity tests (ECD system) (B)
12. Axial and radial flux measurements (B)
13. Reactor automatic control system tests (B)
14. Data processing system tests (B)
15. Reactor trip test (A)(B)
16. Essential supplies system tests (A)(B)
Operating Limits

Reactors power ......................................... 300 MW(Th)
Electrical power ........................................ 120 MW(e)
Mass flow ................................................. 60%
Circulator gas outlet temperature (T1) .............. 285°C
Reactor bulk gas outlet temperature (T2) ............ 435°C
Maximum gas pressure .................................. 40 Kg/cm²

Stage IV - Power raising to 50% design output

1. Manually controlled reactor start up to critical level and
   progressively raise reactor power in 5% steps to 50% power
   level.
2. Repeat all tests in Stage III.

Operating Limits

Reactors power ......................................... 750 MW(Th)
Electrical power ........................................ 300 MW(e)
Gas pressure ............................................. 40 Kg/cm²
Gas flow .................................................. 80%
T1/T2 ..................................................... 285/520°C

Stage V - Power raising to design output

1. Raise reactor power to design output and repeat all tests noted
   in Stage III.

Operating Limits

Reactors power ......................................... 1550 MW(Th)
Electrical power ........................................ 660 MW(e)
Mass flow ............................................... 100% (3850 Kg/sec)
Gas pressure ............................................. 40 Kg/cm²
T1/T2 ..................................................... 285/650°C

The maximum power level at present achieved on the first two AGR
NPP has been restricted to 82% of the design output. This temporary
restriction has been imposed until the 9% chromium steel boiler tube
oxidation rates have been established and at present T₂ is limited to
600°C.

Stage VI - Tests at power

These tests, at various power levels up to the maximum level, are
designed to show the effects of major plant disturbances.

1. Isolation and restoration of one boiler quadrant of the reactor (B)
2. Isolation and restoration of gas circulators associated with one
   quadrant of the reactor (B)
3. Isolation and restoration of one of the two independent CPV
   cooling water systems (B)
4. A controlled reactor shutdown (A)(B)
5. Refuelling tests on irradiated fuel assemblies at central and
   peripheral core positions (B)
6. Control rod run out tests (A)(B)
7. Loss of regenerative feed heating system on main turbo alternator (B).
All appropriate temperature, flux and gas flow perturbations and the effects on the reactor structure are recorded.

6. REGULATORY INSPECTION REQUIREMENTS DURING COMMISSIONING

The nuclear regulatory body must be able to provide the necessary technical resources for site inspection and assessment of the test results during the whole of the commissioning period, which in the case of the first reactor of a specific design may last for at least one year, to provide the necessary regulatory controls and to avoid unnecessary delays at each stage of the commissioning programme.

The specific problems arising from commissioning of NPPs range over a complex field of technology. Appropriate staff, with the necessary experience and disciplines, are required for the solution of these problems and it is desirable for these specialists to be part of the regulatory body.

The procedures for the revision, up-dating, and reissue of commissioning documentation found necessary due to plant modifications and operational limitations, must be strictly applied by all concerned if safety controls are to be properly maintained.

On twin reactor stations, the segregation of commissioning from constructional plant boundaries, especially where common services are provided, presents security and radiological control problems during power raising on the first reactor. The Licensee's Safety Rules must be strictly applied if unauthorised access to safety related plant and equipment and certain plant areas is to be avoided and nuclear safety standards maintained.

7. CONCLUSIONS

The commissioning of the NPP is intended to confirm the design safety performance of the plant and especially the safety parameters and methods for future operation, and requires the close co-operation between the Licensee and the regulatory body.

REFERENCE

1 'Regulatory Inspection Activities on Nuclear Power Plant Sites under construction in the United Kingdom' J V Jeffery
During the commissioning of a nuclear power plant, the owner (licensee) must conduct a successful preoperational testing program before an operating license is issued and must also conduct a successful startup testing program to provide the necessary assurance that the plant can be operated in accordance with design requirements and in a manner that will not endanger the health and safety of the public. The required tests have been delineated by the NRC on a generic basis. The actual tests to be performed at a specific facility are determined on a case-by-case base. The experience of the NRC during inspection of commissioning programs is discussed in the paper.
1. INTRODUCTION

During the commissioning of a nuclear power plant, the owner (licensee) is required by the U. S. Nuclear Regulatory Commission (NRC) to complete a successful test program. This program is conducted in two phases. The first phase, the preoperational testing phase, is conducted prior to the issuance of an operating license and the second phase, the startup testing phase, is conducted during the time period between the initial fuel loading and completion of the 100% power tests.

The preoperational testing phase is designed to prove the correctness of fabrication and installation of systems and equipment in accordance with approved drawings and specifications, whereas the startup testing phase is to provide the necessary assurance that the plant can be operated in accordance with design requirements, and in a manner that will not endanger the health and safety of the public. The required tests for both phases have been delineated by the NRC on a generic basis. The actual tests to be performed at a specific facility are determined on a case-by-case basis. The test program not only demonstrates the performance of structures, systems, components, and design features that will be used during normal operations of the facility but also demonstrates the operational capability of the operating staff.

2. TEST PROGRAM

To provide for the development and safe execution of the testing program, the licensee is required to formulate his plans for the entire testing program and submit them to the NRC for review and approval prior to the issuance of the operating license. To assist the licensee in preparing the scope of his testing program, the NRC has issued Regulatory Guide 1.68, "Initial Test Programs for Water-Cooled Reactor Power Plants." This regulatory guide describes the general scope and depth of initial test programs acceptable to the NRC for light-water-cooled nuclear power plants.

The licensee submits to the NRC a detailed description of the testing program in the Final Safety Analysis Report (FSAR). This description identifies all tests to be performed by title, plus a brief description of the test. Detailed test procedures to implement the
program must be prepared by the licensee. These procedures will include test prerequisites, test objectives, special precautions, system initial conditions, environmental conditions, and acceptance criteria. They must be prepared well in advance of the test to be performed in order to avoid delays in conducting the test.

3. **INSPECTION PROGRAM**

Inspection by the NRC of the licensee's implementation of the testing program begins during the late construction phase and continues throughout the first several months of plant operation until startup testing is complete. The inspection program is conducted on a sampling basis. Through a selective sampling process, NRC looks at the various phases of the test program to assure that it is being conducted and implemented in the manner described by the licensee in his FSAR, and that the results of the test program demonstrate that the plant, procedures, and personnel are in a state of readiness that will provide for safe operations. Examples of some of the areas that are inspected on this sampling basis are as follows:

1. Examination of methods used to prepare testing procedures. The administrative procedures used to implement the testing program are inspected. This includes examining the qualification of personnel writing the test procedures and the licensee's system for review and approval of the test procedures. To facilitate our review of the test procedures, we request that the licensee provide us with approved procedures at least 60 days prior to the performance of the test.

2. Examination of test procedures to determine whether required testing objectives will be met. An examination of selected procedures is performed in which the test objectives and acceptance criteria as defined in the FSAR are compared to the actual test procedure.

3. Examination of fuel loading and initial startup procedures. These procedures are also reviewed against commitments made in the FSAR.

4. Review of test procedures on a selected basis for technical adequacy. NRC inspectors will review a test procedure on a step-by-step basis to verify that the system being tested can actually be tested in the manner described and that the test is valid technically.
5. Witnessing of selected preoperational and power ascension tests and of fuel loading and initial startup to verify that these activities are conducted in accordance with the approved procedures.

6. Review of selected completed tests to verify that the licensee has properly evaluated the test results and that the test results are valid and consistent with acceptance criteria.

4. **INSPECTION EXPERIENCE**

During the process of commissioning a nuclear power plant, problems are encountered. These problems can be the result of inexperience on the part of the licensee as he commissions his first plant or they can be equipment and/or design problems that are detected during the testing program. I will discuss some of the more common problems we have encountered in the preoperational and startup testing phases.

4.1 **Preoperational Testing**

1. The licensee has delayed writing and approving test procedures to the extent that systems may be ready for testing before test procedures have been approved. Since we require that tests be conducted using approved procedures, this creates an atmosphere of urgency in completing the procedures and results in an increased inspection effort to assure ourselves that the procedures implement the full intent and scope of the program. It is our policy not to have the issuance of an operating license delayed as a result of our inspection program; so when the licensee reduces the amount of time available for our inspection effort, the inspection effort must be compressed into this shorter time. This is disruptive of our overall inspection schedule and can cause numerous scheduling difficulties.

2. Delays in construction can also cause delays in the testing program. This can mean that when the licensee's scheduled fuel loading (operating license issue) date approaches not all systems have been tested, and many test deficiencies remain to be resolved. On some occasions such as this an operating license has been issued, but many restrictions are added to the license, limiting the licensee's activities until the restrictions are removed. In most cases, the license will only allow the licensee to load fuel into the core. Although this approach allows the early issuance of an operating license, it places a burden on the regulating agency in increased inspection effort to assure that all license restrictions are followed until the testing program has been completed.
3. As part of our inspection program we require the witnessing of portions of selected preoperational tests. We request that the licensee keep us informed as to the schedule of these selected tests. We also inform the licensee that he is not to hold or delay a test specifically for our inspection personnel to witness. This approach places the responsibility for following the test schedule with the NRC inspector, and since the test schedule is usually changing we can encounter problems with having an inspector available for witnessing a particular test.

4. Major delays in completing the preoperational testing program have resulted when systems to be tested do not meet their test prerequisites. This can be such things as wiring systems not fully checked out, supporting systems not operational, or calibration not completed on all required instrumentation. These delays are generally caused by the licensee hurrying to get a license and taking shortcuts whenever possible, which may lead to further delay than if all prerequisite work was done correctly to start with.

4.2 Startup Testing

1. Our present regulatory requirements allow a licensee to make changes in his facility and procedures as described in the safety analysis report provided the proposed change does not increase the probability of occurrence or the consequences of an accident or malfunction of equipment important to safety that has previously been evaluated in the safety analysis report. This provision of the regulations has been used by some licensees as a basis for deleting specific tests from the power ascension program whenever the program is behind schedule or whenever the licensee concludes that the tests are not important or necessary to prove the plant capability. Although the regulations allow the licensee to do this, it was not the intent of the regulations to allow changes of this nature. As an example, consider a plant which is committed to a turbine trip test and a generator load rejection test at 100% power level. If the test program is running behind schedule, the licensee may sometimes attempt to save time by just performing one of the tests; so he does an evaluation to show that the turbine trip test can be deleted. This evaluation concludes that the generator trip test is nearly as severe as the turbine trip test in demonstrating plant heat removal capabilities, and, in addition, it proves the ability of the turbine governor to prevent an overspeed condition.

We are presently looking into various ways to completely commit the licensee to his published test program without making any changes in the present regulations.
2. A licensee commits to perform a power ascension test program as described in his Safety Analysis Report. This testing program describes the tests that will be performed at specified power levels or testing plateaus. Generally there is no time limit placed on the power ascension test program. Once started the program runs to completion irrespective of a particular time period. In some instances the power ascension program has continued for more than a year. To ensure the safety of operations of the plant when continued operation is performed without completing the full power ascension testing program, the licensee must conduct a certain minimum level of testing to demonstrate that safety-related plant systems and equipment meet design objectives and are capable of controlling the anticipated transients discussed in the FSAR. For example, if a plant were to run at 50% power for a sustained period and the turbine trip test for that power level had not been performed, the performance of that test would be one of the conditions for continued operation at that power level.

3. Some problems that are identified during the power ascension testing program are generic in nature. During the conduct of the power ascension program at a Boiling Water Reactor (BWR), it was discovered that four pipe hangers supporting the 24-inch ring suction header for the Emergency Core Cooling System (ECCS) had failed and the header had sagged approximately six inches. Followup of the occurrence revealed that similar problems were in evidence at four additional BWR facilities which utilize a ring suction header. This problem had not been identified at the four other facilities and could be an indication that the licensees needed to re-evaluate the adequacy of their testing program.

4. Often the testing reveals problems which were not anticipated or previously identified. In one plant, the generator trip test was initiated by manually opening the output breakers. Unexpectedly, this caused a loss of power to all reactor coolant pumps (RCP) because an automatic fast transfer of RCP bus power from house to offsite supply did not occur. Subsequent review showed that the automatic fast transfer only occurred if the output breaker opening was initiated by fault sensing relays.

5. Another type of problem encountered in the commissioning of a plant results when additional information not available at the time the construction permit was issued is discovered. In one instance, for example, a construction permit was issued for two units. During the
construction phase, additional information relating to a geological fault was discovered which increased the seismic design requirements over those originally considered for the two plants. Resolution of the additional seismic requirements is currently in process. The first unit of the two unit facility has been completed, and fuel loading and subsequent operation are presently being held in abeyance pending decisions by NRC on the new seismic considerations.

5. CONCLUSION

Through the efforts of the current NRC inspection program, adverse impact of the identified problem areas has been minimized and maximum assurance that the facilities have been adequately tested has been gained. We are currently in the process of undertaking some changes in our present inspection program as we look ahead to the future growth of the nuclear industry. As you have already heard, in the near future, we will initiate a Resident Inspection Program at eight selected sites. It is planned to extend this program to all sites including those with plants in preoperational and startup testing. With the inspector on-site, NRC awareness of facility status will be enhanced as well as our ability to respond to facility problems identified during the testing program.

You also are aware that we are considering the concept of having NRC inspectors perform independent confirmatory tests at the Licensee's site. The purpose of these independent measurements would be to verify that the licensee's management system is performing properly. It is expected that the concept of independent measurements will have application during plant commissioning.

Nuclear energy is a valuable element in America's overall energy program, and as this program expands, the Nuclear Regulatory Commission will continue to ensure that the health and safety of the public is maintained. We believe that this can be accomplished by ensuring that the commissioning of nuclear power plants is achieved through effective testing programs and inspection of these programs by the regulating agency.
SESSION III

PROBLEMS AND PRACTICAL EXPERIENCE OF REGULATORY INSPECTION DURING COMMISSIONING.

PANEL DISCUSSION

CHAIRMAN: ECKERED

ECKERED: All speakers in this session have given examples of experiences and problems. I suggest that we try to concentrate the discussion on these experiences and problems because we have not much time. We have already one question left from the presentation and that was concerning the paper by Mr. Figueras.

VAN DATSELAAR: My question was concerning the problems to be faced when you have to apply some new codes as, for instance, the new issue of the ASME 11 to an old plant and which kind of problems your experience has faced.

FIGUERAS: Of course, we have problems in implementing new regulations to old power stations. As in Spain we use the reference plant concept which normally is referred to an American plant, in this conditions the type of technical standard to be applied for each power station is clearly defined. Then, the Spanish power station has to do the same, they have to apply the American regulation, except if in Spain there were other rules in force saying which of them had to be applied. In practice we depend a little bit on what the licencsee wishes to apply. If he wants to stick to legality, there is no other way than let him do so. On the other hand, if he sees that the standards in force in Spain are covering automatic core inspection, according to the edition of 1974, in the last revision of ASME 1974 and still more in the addenda of 1975 and 1976, where ultrasonic methods are explained more in detail, for this automatic inspection, then, the licencsee turns to these rules and then we can apply those rules. But if he wants to use the legally applicable according to the American standard, that is the one which must be applied.
BUERGO: This is a very important point in connection with the old light water reactors running for some years in Spain. I will mention to you the Zorita Plant, that is a pressurized water reactor, and the boiling water reactor at Santa María de Garoña. For these plants we do not have the base-line inspections. On the other hand, we have problems because, for example, that plant doesn't have a room to store the necessary equipment for ultrasonic inspection. This is in my opinion the case of different countries with old equipment and old power plants. We are very much interested to hear your opinion and how you are going to treat that problem.

DOPCHIE: I would like to mention how we do it in Belgium. In Belgium, we have a full revision of each plant every ten years. In the mean time we let the utility just go, except if something dangerous would show up, of course. But if this is not the case, we let them go for ten years. After ten years we revise the whole thing. What will happen in ten years, I don't Know.

LEWIS: I cannot talk about light water reactors, but I can tell you something of the gas-cooled reactors. The base-line inspection is completed before raising power, while the reactor is still in an inactive state. Then, every two years, the reactor is shut down for a full statutory inspection. These in-service inspections would then use remote close service television facilities into inaccessible areas of the reactor where these are provided. Of course, on the old magnox plants these facilities for in-service inspection are very primitive, but in the latest plants, the design must provide for proper facilities for in-service inspection to be installed. We use the photographic evidence, to see that there is no unacceptable deterioration taking place, every two years. Of course, some parts of the plant are still available for direct inspection by inspectors, such as the border areas where contamination has not
reached a prohibitive level, and where working times up to one or two hours are permitted. But specially controlled procedures have to be used during the surveillance by the inspector, he has himself to be protected. Proper escape facilities and additional safety systems must be provided for him if he goes into these potential hazardous situations. But we do tend to want to use remote inspection facilities wherever possible.

VAN DATSELAAR: I think that some of the problems just mentioned are experienced in our country in the application of, for instance, the ASME codes and the safety classification of the different systems. I think it is a question of more or less, first of all, backfitting, but secondly, you have to make a balance of comparison between the dose to the operator or the inspection personnel and the safety of the system. Maybe this kind of decisions are not that easy, but we feel that we have to balance the necessity of the inspection, and not by remote control because there is no opportunity for it, against the risk for the personnel itself.

DOPCHIE: Mr. Lewis and I answered differently at the same question. Of course we have not an in-service inspection in Belgium just the same as it happens according to the latest edition of the ASME 11 before the plant is authorized. But, I was trying to say, I was answering at the question of backfitting. So, we do not have any backfitting for ten years in any respect which concerns the ASME 11 or any other problem. So, I want to make sure that there was not misunderstanding, but we have an in-service inspection, of course.

FIRING: I would like to follow on the point which Mr. Servant touched upon during the previous session on the design, manufacturing and construction, and that is the fuel itself. We have heard a lot about the
conventional testing and inspection, both during design, manufacturing and construction and now again during commissioning, but the behaviour of the fuel itself has been rather lacking. It would be interesting to hear what the licensing authorities do in this field. After all, a lot of the problems come from the fuel itself.

LEWIS: In the U.K. the causes are very large. A fuel testing programme goes on in research reactors run by the United Kingdom Atomic Energy Authority or BNFL which is taking over the responsibility for fuel fabrication. If you think of the magnox system, where a fuel element is a single entity, a very careful testing of this fuel has been done not only during the commissioning programme prior to nuclear heating, but it continued during the life of the fuel. The performance of the magnox fuel and its operating conditions has resulted in a considerable extension to the irradiation life-time of the fuel in the reactor. Now, if you go on to the AGR fuel, here you have a fuel assembly similar to those used in the water reactors, a very large assembly of about 7 feet long, about 10 inches diameter, consisting in a number of fuel elements with a number of separate pins, 36 fuel pins per fuel element and 8 fuel elements per fuel stringer connected to a plug-assembly which contains the gas flow variation device at its top. This has presented a certain problem in the U.K. because the prototype tests did not reveal, I think, due to the fact that they did not use the full power parameters which would be met in the reactor, certain modes of variation which were damaging to the plug-assembly, not to the fuel, but to the plug-assembly. As you probably know from reviews given by the electricity authorities in the U.K., considerable delays in commissioning occurred due to the fact that, during the flow tests which I have referred to, where we have loaded fuel into the reactor and subjected it to conditions, particularly of flow and density, equal to or greater than the conditions which will be met in operation, apart from, of course, the high temperature.
This showed that a mode of vibration was introduced into the plug-assemblies which caused real damage to the flow and regulation devices and to modify 300 assemblies in each reactor, to take them out to modify, it was a considerable time consuming operation but it was done on site and when retesting them it showed that the gag devices, as we call them, were made stable under these very high operating conditions. From then on, it is proved that we have to monitor continuously the integrity of that fuel-assembly and we do that on every fuel assembly, so that, in operation, gags may be changed and if they approached the threshold of vibration which could cause damage, they are prevented from causing this damage and up to now this has been quite successful. So, there is an example of the precommissioning monitoring of the fuel and in the post-monitoring of the fuel during operation.

Mr. CLEMENT: Je vais essayer de faire quelques commentaires sur ce problème de combustibles. Beaucoup de nos collègues qui sont dans cette salle savent toute l'importance que nous attachons à cette bonne tenue du combustible, ils savent que notre souhait le plus cher serait qu'il n'y aille pas du tout de rupture de gaines pendant le fonctionnement. Malheureusement nous savons bien qu'il n'en sera pas toujours ainsi. Le problème qui se pose alors, est de savoir jusqu'à quel seuil d'activité en produits de fission dans l'eau du circuit primaire nous devrons laisser faire les choses, nous devrons laisser la centrale continuer de fonctionner. Il est difficile de répondre à ce problème. Ce que je peux dire c'est que cela dépend aussi de la phase de fonctionnement dans laquelle nous nous trouvons. Je m'explique: si par exemple, en cours de démarrage d'une centrale nucléaire, des essais ont montré qu'il serait intéressant, à court terme ou à moyen terme, d'aller faire des vérifications, d'aller faire des inspections, et bien, tout doit être fait pour que ces inspec-
tions, ces vérifications se font dans de bonnes conditions et que l'on distribue pas des règles, si j'ose m'exprimer ainsi, d'une façon inutile. Donc, à ce moment là on peut être amené à demander à l'exploitant de maintenir l'activité de son circuit primaire très basse et même d'évi-
ter de fonctionner avec la moindre rupture de gaines, donc de surveiller et d'avoir des moyens les plus efficaces possibles de surveiller une eventuelle augmentation des produits de fission dans le circuit primaire.

SERVANT: Si vous permettez j'ajouterais peut-être un mot. Mr. Clément vient d'évoquer l'aspect curatif, peut-on dire, de ce problème concernant les combustibles. Cet à quoi je faisais allusion tout à l'heure, c'était l'aspect préventif, c'est-à-dire, la question de savoir quelle mesure il fallait prendre, quel programme de qualification de combustible par exem-
ple, il fallait mettre au point et avec quel type de surveillance, pour éviter dans toute la mesure possible les ruptures de gaines en fonction-
nement, c'est à quoi je faisais allusion, ça situe un peu en un mot le fonctionnement du reacteur auquel Mr. Clément se référait.

COURVOISIER: I think it is easier not to interrupt the discussion by gi-
ving back the microphone without having said anything. Mr. Servant has already asked the question which I wanted to ask. What should be done, just taking up the question of Mr. Tendler, shouldn't we go a little more into the domain of checking the fuel? I might ask, is the fuel really a throw-away part of the whole business, of the whole plant, so that we can disregard it?.

ECKERED: I'm not sure that we will be able to answer the question. It is so interesting and valuable that the fuel problems are taken up but we still have some questions on the experiences raised by the speakers. We have, I think, a lot of valuable things to discuss.
G. BERNAL: I should like to comment a little bit on what we do in Spain in relationship with the inspection of irradiated fuel when the power station is in reload period.

As you know, we have two types of LWR's. In Garoña where we have a BWR, during each reload we analyse the 400 fuel elements by the "sipping in core" technique. The inspection gives a big importance to these kinds of tests. The time spent on the inspection of 400 elements is about a week. The regulatory inspection is not carried out during the whole week, but there are certain parts which we consider of big importance. The first of them, the most important for me, is to check that the analytical laboratory is in proper working condition, that it's not contaminated, and it is very important that the multicanal equipment is perfectly calibrated for the isotopic analyses of the water recovered. We have already several years of experience and a number of elements have been rejected following this procedure. At the beginning, I don't remember now the exact number, there were a lot of them, rejected because the first elements used in Garoña, we call them 7 x 7 did not behave properly and developed some failures. This year the Garoña station had to reject 19 fuel elements following this procedure. At the moment there are no elements of the so called "old type" and they are now of the 8 x 8 type.

On the other hand, in the PWR "José Cabrera" station the fuel inspection is done by underwater TV cameras and this is the only inspection being done there. About one third of the fuel during reload period is picked-out and the remaining two thirds is inspected with underwater TV cameras. All this is recorded in videotape so that in the coming inspections we can have a comparison method of a determined fuel element inspected.
ECKERED: I would like to raise one of the questions mentioned by the speakers and see if the panel has any comment on it; that is what was said by Mr. Backström about the problems of lack of personnel with operating experience on power plants. I know that some of the other speakers commented on that when we prepared the morning session. Is there somebody in the panel who would like to say something about it right now?

LEWIS: For the recruitment of inspectors from the electrical utilities of the U.K. Atomic Energy Authority, of course we would prefer people with a plant operating experience, but, although I am myself an ex-operator -four years on a nuclear power plant - and I find this very useful in discussing operational problems with the licensees, there is no reason why properly qualified engineers of other disciplines cannot gradually acquire this knowledge and expertise equally well. It is a case of what is available and what salaries you are prepared to pay an inspector in comparison with public utilities. If your conditions are more favourable, you get a large number of inspector applications. If they are less favourable, I am afraid you have to suffer the consequences. It is a case of what you are prepared to pay for what you get. This is a matter for each authority to think about.

VAN DATSELAAR: We have only a rather poor experience because of the limited number of power stations, but for the inspectors we require nuclear experience and we try to attract them either from a research institute or from the nuclear power station itself.

GRIER: I want to say first, that there are two types of inspectors, one is the specialist and the other the generalist. In connection with specialists, we are looking for the special engineering disciplines. Cer-
tainly, I think, an operating experience is not necessary. When we are looking for generalists, or project type inspectors, we feel that operating experience is important and in our earlier recruitment there was a requirement of the order of 5 years experience in operation. We do have this on the National Laboratories, the production reactors operated by the Atomic Energy Commission, where we started our programme initially. We now get a number of our inspectors from the nuclear Navy and we made exchanges in operating reactors there. Particularly, I think in the area of commissioning, part of the programme that we are discussing now, it is important that inspectors, the principal inspectors, have operating experience; I think we have put the most experienced inspectors in this phase of the programme, I have to say that we are presently hiring less experienced inspectors and we increase our effort in in-house training. We have faced this problem of salary, if you will, having gone too high in terms of what we must pay the inspectors, on what level we recruit. So, we are making an effort to go to less experienced inspectors, and maybe, even some without experience. We are going to full scale in-house training programmes to train inspectors.

COURVOISIER: I am afraid that this is not the last word, it is a very delicate question. Politicians, once in a while, have the funny habit of giving you a heavy task but not the means to carry it out. What are your colleagues doing in case you should do inspections and you do not have enough personnel to do it? Are you just padding down on your demands on the inspection programme in order to make those ends meet? Or are you giving the utility a call: "please shut down, we do not have time to inspect you as we should at this point in time?". Well, we will inform you once we can come to see you".

Eckered: End of session.
SESSION IV, SPECIFIC PROBLEMS AND PRACTICAL EXPERIENCE OF REGULATORY INSPECTION DURING OPERATION.
Conclusions of Session IV

Specific problems and practical experience on regulatory inspection during operation.

/// - ///

The first three papers are of a general character and are related to experience during operation in Spanish, U.K. and U.S.A. power plants respectively.

Particularly, they presented lists of incidents and safety-related occurrences in the plants, together with special forms to be transmitted for information to the Regulatory Bodies.

The other three papers dealt with more specific questions such as pressure tests made at Chooz power station after ten years of operation, filter and leakage tests made in Italian nuclear plants, and management of experience gained from safety-related occurrences in Swedish power plants.

Following the presentation of each paper, there have been some questions for a better understanding of the paper itself. At the end of the session, a Panel was held in which a discussion took place streamlining the main points which arose from the Session.

A list of the main arguments discussed is:

1 - Need, duties, powers and composition of the Safety Committee in a nuclear plant. It turned out that in some countries the Safety Committee is made only of people of the licensee's staff, and in some others experts from outside are called on to join the Committee when a particular decision has to be made; sometimes people from the Regulatory Body participate as observers to the Committee meetings. Generally, this Committee has no powers to make decisions involving substantial and safety-related changes to the technical specifications, but its function - which has been recognized to be very important - is simply to give advice to the Station Superintendent.

2 - Interest was shown for safety problems of old plants approaching the end of their design lives.
3 - Sometimes the results of the inspection are discussed with the licensee and then the Regulatory Body sends a written report to the licensee. Sometimes inspectors report directly to their Authorities for appropriate actions.

4 - Specific questions have been put regarding technical problems arisen from filter tests.

5 - A rather general discussion was held about health protection problems related to operation experience in nuclear plants. A better knowledge of the dose could also lead to improvements in the design and operation of the plants.

6 - In connection with information on occurrences, it was noticed that even minor events not always and not necessarily related to safety could be if importance as feedback for a better design and operation
INSPECTION DURING OPERATION OF A NUCLEAR POWER PLANT IN SPAIN

R. Gutierrez Bernal
Junta de Energía Nuclear
Madrid (Spain)

La presente Comunicación resume las actividades de control y vigilancia así como los resultados de la explotación de las tres centrales nucleares en funcionamiento actualmente: JOSE CABRERA, SANTA MARIA DE GAROÑA y VANDELLOS. Las dos primeras funcionan con agua ligera pero con diferentes características de presión y ebullición y la tercera funciona con gas grafito. Esta comunicación analiza los principales aspectos de la experiencia obtenida con estas tres centrales, bajo el punto de vista de inspección.

The present Report summarizes the control and surveillance activities, as well as the operating data and results of the three nuclear power plants presently in operation: JOSE CABRERA, SANTA MARIA DE GAROÑA and VANDELLOS. The first two are light-water type, with different pressure and boiling characteristics and the third is of the gas-graphite type. This report analyzes the main aspects, from an inspection point of view, of the experience obtained in these three plants.
1. **INTRODUCTION**

The present report summarizes the control and surveillance activities, as well as the operating data and results, of the three nuclear power plants presently in operation: JOSE CABRERA, SANTA MARIA DE GARONA and VANDELLOS. The first two are light-water type, with different pressure and boiling characteristics and the third is of the gas-graphite type. This report analyzes the main aspects, from an inspection point of view, of the experience obtained in these plants. We are summarizing on chart 1 the main characteristics and reference data of the power stations in operation.

2. **SURVEILLANCE AND CONTROL**

Maximum safety and availability in a nuclear power plant can be obtained if the surveillance and maintenance measures during the operation are strictly carried out. In this regard, the following points should be given special consideration:

- Fulfillment of all of the terms indicated in the operating authorization.
- Fulfillment of the safety regulations and criteria during operation.
- Periodic inspection and checking programs, especially in-service inspection of nuclear steam supply systems.
- Evacuation program of radioactive waste into the atmosphere and its effect on ecology in the surrounding area.
- The refueling program.
- Analysis of the radiation dose received by the personnel.
- Analysis and evaluation of simulated emergency situations.
- Periodic revision of the preceptive documents regulating the operation of the plant which, according to the Regulations on Nuclear and Radioactive Installations, effective presently, are the following:
  - Safety Report
  - Operation Regulation
  - Operation Specification
  - Radiological Protection Report
  - Emergency Plan

During the commercial operation stage of the plants
<table>
<thead>
<tr>
<th>NUCLEAR POWER PLANT</th>
<th>JOSE CABRERA</th>
<th>SANTA MARIA DE GARONA</th>
<th>VANDELLOS</th>
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<td>SITE</td>
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<td>Vandellós (Tarragona)</td>
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<td>HIFRENSA</td>
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<td>BWR (G.E.)</td>
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<td></td>
<td>17/7/68</td>
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<td>COMMERCIAL OPERATION DATE</td>
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<td>Mayo 1971</td>
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the control and surveillance during their life is carried out by means of two types of checking: normal control checking and special checking.

The normal control checking tries to verify if the plant is operating within the limits and conditions approved by the Authorities and reflected in the plant's preceptive documents.

The special checking refers to verifications which the plant must carry out throughout its existence in order to be aware of the condition of its components regarding nuclear safety; pressure barrier components in the primary circuit, fuel elements and internal components in the vessel. This refers to in-service inspections which are basically carried out by means of non-destructive test techniques: direct and remote visual examination, hydrostatic tests, penetrant liquids, radiographs and eddy current test.

The results of the inspection are stated in the Inspection Certificate by triplicate; one of the copies is sent to the Provincial Delegation of the Ministry of Industry where the plant is situated, another copy is sent to the JEN and the third one is given to the utility or to the person who, representing the utility, has been present in the inspection. At any case the utility is invited to be present at the inspection and sign the Certificate. This signature gives the utility the right to state the facts and opinions that he may find pertinent.

On the other hand, the plant's performance is also controlled by means of analyzing periodic and non-periodic reports which are sent by the plant in compliment with the administrative regulations, included in the operating specifications which refer to the organization and administrative procedures required to operate the plant, from a nuclear safety point of view. The administrative regulations refer specifically to the organization, operating regulations, registration and filling of information, administrative actions which are to be taken by the owner-operator in case of abnormal situations occurring during the plant operation or if any one of the imposed safety limits are exceeded, as well as the content and frequency of the technical reports related to the plant which should be sent to the Administration.

In accordance with these administrative regulations, there will be a Nuclear Power Plant Safety Committee and a Nuclear Safety Owner's Committee.
The mission of the first Committee is to counsel the Plant Superintendent regarding technical problems related to: operation, reactor engineering, chemistry and radiochemistry, metallurgy and radiation damage, instrumentation and control, periodic inspection of the components and radiological protection to the extent in which they affect the plant's nuclear safety. The missions of the second Committee are as follows: to evaluate the plant's operation and verify if this operation fulfills the terms of the operation permit; to periodically check the plant's official documents; to evaluate and approve the proposed changes to the operating permit, for their presentation to the Administration and evaluation and analysis of abnormal situations or situations which have resulted to exceed the safety limits and inform the Administration accordingly.

The Inspection will verify if each plant is fulfilling the above mentioned administrative regulations, check files and registers, as well as the contents of the Minutes of meetings held by the Plant's and Owner's respective Committees on Nuclear Safety, as well as the frequency of these meetings.

The monthly operation reports should contain, as a minimum, the information attached in Annex I. Annex II shows the formats used by the inspectors for monthly control and follow-up of the plants in operation. Attached is a list of the information which the non continuous refueling plants must submit to JEN (Annex III).

3. OPERATOR'S AND SUPERVISOR'S LICENSES

Under a safety point of view, the fact that a nuclear power plant is well designed and built is not enough. It must also be run properly.

In Chapter I of the Regulations for Radioactive and Nuclear Installations, the necessary requisites for obtaining these licenses are established. These Regulations also point out the obligation of a specific title for being Supervisor of the Radiation Protection Service proving his capacity of the responsibility which this position involves.

These licenses and titles are issued by the Nuclear Energy Board (JEN) to those who personally request same and who, having the recommendation of title-holders,
can justify before a special Board created for this purpose, that they are worthy of same.

In addition to a basic knowledge, those who request a license must demonstrate their specific knowledge related to the safety measures of the installation they will handle; this knowledge must include both technical and administrative aspects of safety. Guidebook GSN-02/76, issued by JEN, establishes the necessary requisites for obtaining and using of the operation licenses of nuclear power plants.

Experience has shown that to check the files, prepare inspection questionnaires, correct and classify the tests carried out and draw up reports for each nuclear power plant represents a great deal of work. This effort will be increased considerably in the near future, in view of the number of nuclear power plants foreseen in our Country. Chart 2 shows the number of operator and supervisor licenses which have been granted for each nuclear power plant in operation. As we can see from this chart, there is a limit to the number of licenses granted (operators and supervisors) corresponding to the starting-up of nuclear power plants. However, even if no nuclear power plant would be commissioned, tests are given every year for granting licenses and this situation will probably remain unchanged in the future.

The average effort required for granting a license, per installation, is estimated at one week per man. This job consists in negotiating the necessary proceedings, prepare the theoretic examination, performing and correcting it and proceed with the practical examination in the installation itself. Based on an average of five license requests per year, distributed among the three plants presently in operation, and without taking into consideration the first start-ups, we arrive to the conclusion that an effort of 5 weeks per man per year is required. This job is basically carried out by the Inspection service.

The effort required to grant operator licenses for the Almaraz and Lemoniz (1978) units is estimated at 20 hours per man, this job being basically carried out by the Inspection service.
<table>
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<tr>
<th>YEAR</th>
<th>LICENSE TYPE</th>
<th>JOSE CABRERA</th>
<th>GARONA</th>
<th>VANDELLOS</th>
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</table>

TABLE 2
OPERATOR & SUPERVISOR LICENSES GRANTED
4. EXPERIENCE ACQUIRED DURING THE OPERATION OF THE PLANTS

4.1 JOSE CABRERA Nuclear Power Plant

This plant is located in the municipal boundaries of Almonacid de Zorita, in the Guadalajara province, on the left bank of Tagus River, between the Bolarque and Zorita dams, taking the necessary water for its cooling system from the latter. In a straight line, the distance from the plant to Guadalajara is 40 Kms and to Madrid 66 Kms.

The plant started its commercial operation in February 1969 and the operating results are considered as satisfactory. During its existence, several steps have been taken to solve the problems which have arisen being basically the following: leaks in the pressurizer safety valves; breaks in the piping in the area where the pressure is reduced between the primary system and the chemical and volumetric control system; losses through the controlled release valves; leaks in the charging pump; also the play existing between the joints in the core's vertical plate baffles was reduced and it is estimated it was the cause of crack in some rods of fuel near to the joints, by vibrations of the same rods. During the shutdown for the second refueling, this play was reduced and until now no abnormalities have been observed. The availability of the vital bar was improved, and therefore the frequency of sudden outages has been reduced by installing a second static inverter in parallel to the one that existed between the vital bar and the continuous bars. The liquid waste treatment system has also been improved by increasing the concentrator/evaporator efficiency and at the same time improvements are also being carried out in the gas treatment system, installing additional filters and retainer tanks, before discharging the gases into the atmosphere.

In general, the fuel performance has been good thus allowing us to reach a burnup comparable to those indicated in established design patterns. In the in-service inspection carried out, no rod collapse or other effects related to densification were detected. Six refueling have been carried out and up to now a total of 134 elements (spent fuel) have been extracted.
4.1.1. In-Service Inspections

Six inspections have been carried out coinciding with the refueling in 1971, 72, 73, 75, 76 and 77, in additional to a pre-operational (fingerprint) inspection. By means of non-destructive tests, several defects were discovered in the primary circuit components, such as a reflector located near the welding with the steam generator’s inlet nozzle, in the hot line, interpreted as shrinkage in the tube manufacturing and a reflector, found in the 1973 inspection, in the vessel cover, which had been evaluated, at the beginning, as an 85 x 10 mm crack caused by lack of fusion at the welding edge. Later, in 1974, it was concluded that this was divided in two parts, 65 x 10 and 25 x 10 mm with a 5 mm separation between them. Finally, in 1975, it was again inspected — following the 1974 Edition ASME Code rules and using several ultrasonic units belonging to the firm MATEVAL of United Kingdom — and it was concluded that this was a sole reflector of 85 x 4 mm located on a 25° incline to the welding axis plane, without specifying its cause, as the ultrasounds indicate a value of 50% less on the Distance-Amplitude Curve (DAC), nor the area where it is found (base metal, welding or zone affected by the heat, HAZ). In view of these circumstances, the plant’s owner has decided to inspect this area during each refueling stoppage in order to evaluate the possible growth of the crack, using the 1975 inspection as a basis for comparison.

The biggest problem existing in this nuclear power plant regarding to in-service inspection is its age, built in the 1960-1970 decade, generating difficulties for using the non-destructive test techniques. In addition, during construction these requirements were not taken into account and there are areas where access for carrying out non-destructive tests, required in the ASME Code, is very difficult or impossible and, as a consequence, components which are essential for the plant’s existence will have to remain unexamined for over 10 years.

With reference to the steam generator,
annual eddy current tests are being carried out in the tube bundle for the last 3 years and, to date, only 3 tubes of the 2604 contained in the steam generator have been plugged. These favorable results are due to the special care taken in the chemical properties in the secondary circuit, which is regulated with phosphate treatment.

4.2. SANTA MARIA DE GAROÑA nuclear power plant

It is located on a turn in the Ebro River, near Santa Maria de Garoña, in the province of Burgos, at the tail-end of the Sebrón reservoir, from which gets its coolant water.

The plant started commercial operation in May 1971 and up to the present time it has proved to be an overall reliable plant. Its yield can be considered as acceptable compared to other similar plants. The most important outages and limitations corresponded to the main turbine steam regulation system, to leaks produced in the fuel cladding and to several failures in the plant's conventional components. The power regulation systems by means of control rods as well as by recirculation flow variation, have given a good performance. The liquid waste treatment system in the initial project proved to be insufficient and therefore the plant has improved this system by adding a new evaporator and additional tanks and their corresponding pipe networks, valves and necessary equipment which has represented a reduction in the liquid wastes of a factor of ten, approximately. For the same reason, the plant has installed a new gaseous waste treatment system (off-gas) which has already been put into service, decreasing the chimney discharges by a factor of 50. The plant has built a new solid waste warehouse, capable of temporarily storing material corresponding to five years of operation.

The fuel performance has been one of the main problems. Until now, the number of refuellings has been 6, of which a total of 430 spent fuel elements have been extracted. Small perforations in the fuel clad produced leaks of fission products which increased the activity of the gases expelled through the chimney, as well as the specific activity of the coolant and, as a consequence, the radioactive liquid wastes.

During the programmed outage for refueling
and in-service inspection, corresponding to 1977, when disassembling the spargers, an erosion phenomenon was detected in three of the four transition rings (safe end) of the feed water system.

This erosion phenomenon appeared in the zones of contact between the transition rings (safe end) and the thermal sleeves. The depth of the erosion in one of the safe end was about 9 mm and in the others about 1 mm. It is supposed that the erosion has been produced by the pass of the water through the thermal sleeves and the transition rings.

The utility presented to the Administration two options of welding: through the temper bead technique, which does not require a later thermal treatment and through the tungsten arc technique (TIG) with a later thermal treatment.

The second option was adopted after the comparison between the theoretical results of distribution temperature and thermal efforts, carried out by GENERAL ELECTRIC, and the experimental values of temperature, carried out by COOPER HOT WORK ESPAÑOLA, obtained in a mock-up to real scale.

Actually, the repair has been finished and non-destructive tests have been carried out. This repair implied a shutdown of about 3 months.

4.2.1. In-service inspections

In this BWR-3 type plant, up until 1977 the owner carried out 7 inspections, including the 1970 pre-operational one (baseline ultrasonic inspection). In addition, in October 1974, and independent of that year's shutdown for refueling, an in-service inspection was carried out to observe the condition of the 4" bypass tubing of the recirculation circuit as a consequence of the cracks observed in the American plants in DRESDEN, QUAD CITIES and MILLSTONE. The results were positive, in other words, no defects were found.

As in the case of the JOSE CABRERA nuclear power plant, this plant was designed and built before Section XI of the ASME Code was
established and, as a consequence, accessibility for inspection has many limitations. In some cases they are due to physical impossibility inherent to the design and in others to the radiation doses associated with the work required for uncovering the element to be inspected and to cover it again. For example, the free space between the vessel wall and the concrete shielding is about 11 cms. and there is no access to the vessel's skirt-support. Therefore, these components cannot be inspected until the non-destructive test techniques improve and new devices are marketed in smaller sizes.

Regarding the results obtained during the inspections, these can be considered as correct. Although during the 1973 outage the nozzle (safe end) N11 failure was not discovered in the return line of the control rod system (in which in December 1973 a crack of some 60 mm. in length, had been detected through which primary coolant was leaking and this was repaired by replacing the safe end), in the 1977 non-destructive tests, the mentioned erosion phenomenon was discovered in the safe-end of the N4 nozzles, of the feed water circuit.

4.3. VANDELLOS Nuclear Power Plant

It is located on the Mediterranean coast, in the municipal boundary of Vandellós, in the Tarragona province, and it uses sea water for its cooling system.

The plant started its commercial operation in August 1972 and, in general, its performance has been satisfactory up to the present time. The plant's non-availability can be traced to the very sophisticated instrumentation found in this type of plant, with a large number of small components. The loading machine and, in general, the fuel maintenance device have required a considerable maintenance effort. It was necessary to install new diaphragms (flow regulators) in the steam generating towers, in order to maintain the most homogenous temperature distribution in the reactor.

Since October 1973 there have been several leaks produced in the steam generator. The number of
leaks found out until the present time is of 19, the last one on October 1976. During the last year, the plant carried out a programmed shutdown for one month to make a general revision of the plant. Special attention has been given to the steam generator leaks. For this purpose, four windows have been opened on the north wall of tower number 27, making possible a gamma-graphic analysis of 120 elbows. At the beginning, we concluded that it was a phenomenon of erosion–corrosion at the elbows where the soldering is located, according to the course of the fluid, before the elbows, and that the inner rugosity could produce an increase on the speed of the water circulation when being steamed.

The plant has descended the zone of steaming as well as its maximum level of power which, at present, is about 90% of the nominal power.

During 1977, breakings in 19 irradiated fuel elements, stored at the pools, have been detected. After examination in the hot cell they have been dully packed and stored again in the pools.

It has been estimated that these breaks have been caused due to a long storage in the pool.

Also, it has been detected a break in a fuel element of the reactor through a numbering increase in the burst pin detection system. This element was taken out of the reactor, examined in the hot cell and, properly packed, stored in the pools.

4.4. Comparative summary of the three plants

On chart number 3, a comparative summary of the three plants in operation is shown, in relation with the gross electric production. Your attention is called to the fact that in the calculation of the percentage of the produced energy it has not been deducted the time spent in the different refueling periods and the in-service inspection periods.

5. EFFORTS CARRIED OUT

On an average, the minimum effort required to prepare an inspection is estimated at one week per man and
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<td><strong>Gross Energy Produced</strong></td>
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<td><strong>Jose Cabrera</strong></td>
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<td>923.7</td>
<td>1006.3</td>
<td>896.5</td>
<td>917.3</td>
<td>1073.3</td>
<td>1134.3</td>
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<td>66.0</td>
<td>71.9</td>
<td>64.0</td>
<td>65.5</td>
<td>76.5</td>
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<td>(2)</td>
<td>52.7</td>
<td>61.5</td>
<td>58.8</td>
<td>71.9</td>
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<td><strong>Vandellos</strong></td>
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<td>3.770.5</td>
<td>3.506</td>
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<td>78.2</td>
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(1) Grid connection on July 68
(2) Grid connection on March 71
(3) Grid connection on May 72
the job of carrying out the inspection and preparing the corresponding report at two weeks per man, which amounts to an estimated total effort of three weeks per man for each inspection.

The yearly average effort required to analyze the periodic and non-periodic reports for a plant in operation is estimated at 15 weeks per man.

Therefore, and in accordance with the above, based on six inspections per year for one plant, the total effort is as follows:

<table>
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<tr>
<th>Weeks per man/year</th>
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<tr>
<td>Inspection preparation</td>
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<tr>
<td>Inspection and report preparation</td>
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<tr>
<td>Analysis of periodic and non-periodic reports</td>
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<tr>
<td>Operator and supervisor testing</td>
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<tr>
<td>TOTAL ......</td>
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</table>

For a proper control at the present plants in operation, we estimate that the minimum number of inspections per plant and per year should be six, under normal operation conditions, and thus the minimum effort required per plant and year is 35 weeks per man, as indicated in the above figures.

However, this effort has not been achieved, due to a lack of inspection personnel in all the plants, every year. A list of the number of inspections carried out by year, for the three plants in operation, is attached (figures 1, 2 and 3).

6. ORGANIZATION

The organization considered as the most suitable is presented in Figure 4, where is indicated the number of inspectors, bearing in mind that this chart covers the period up to the time when the first units in Almarz and Lemoniz (1978) will start operation.

The job descriptions for the different positions are outlined below:
1. CHIEF OF INSPECTION GROUP IN NUCLEAR INSTALLATION IN OPERATION

Coordination and supervision, following the instructions received from the Operative Inspection Unit Chief, of the inspection to be carried out in nuclear installations during nuclear tests, temporary and definite operation, including:

- Verification of fulfillment of the technical operating specifications and other preceptive documents.
- Evaluation of the periodic and non-periodic operation reports.
- Participation in the Board which grants Supervisor and Operator licenses.

2. INSPECTOR IN CHARGE OF THE NUCLEAR POWER PLANT

Coordination, supervision and inspection, following the instructions received from the Group Chief, for supervision during the start-up and operation of the nuclear power plant to which he has been assigned as well as evaluation of the periodic and non-periodic reports of its operation. Collaboration with the Inspectors in Charge.

3. INSPECTOR SPECIALIZED IN NUCLEAR TESTS

Coordination, supervision and inspection, following the instructions received from the Group Chief, of all tests related to the core both for nuclear power plants in commercial operation as well as those which are in the starting-up stage. Study of the documentation related to this speciality. Collaboration with Inspectors in Charge.

4. INSPECTOR SPECIALIZED IN IN-SERVICE INSPECTION TECHNIQUES

Coordination, supervision and inspection, following the instructions from the Group Chief, of all the activities related to in-service inspection both for nuclear power plants in commercial operation as well as for those in the construction stage (reference inspection). Study of the documentation related to this speciality. Collaboration with Inspectors in Charge.

5. INSPECTOR SPECIALIZED IN RADIOLOGICAL PROTECTION

Coordination, supervision and carrying out steps in accordance with instructions received from the Group Chief, related to radiological protection
in the nuclear power plants in commercial operation. Inspection visits during simulated emergency situations as well as study of the documentation related to this speciality. Collaboration with the Inspectors in Charge.

6. INSPECTOR SPECIALIZED IN MAINTENANCE

Coordination, supervision and inspection, following the instructions from the Group Chief, of the activities related to maintenance, both electrical and mechanical, in the nuclear power plant in commercial operation. Carrying out and maintenance of a technical file corresponding to preceptive tests carried out in the various nuclear power plants. Collaboration with the Inspectors in Charge.

7. CONCLUSIONS

The experience obtained in the inspection of the three plants in operation allows us to present the following conclusions, as a summary:

Regarding the plants

1.- The operation results of the three plants can be considered as satisfactory.

2.- The three plants are operated by staff judged as responsible.

3.- We consider necessary that utilities of the three plants keep, independently of the usual operation staff, another group acting as a technique help to the plant, specially in subjects related to the in-service inspection, refueling and quality assurance.

4.- The verification in the carrying out of periodic tests by the plants, has given as a result the permanent up-to-date of the technique files of the plants.

5.- It is considered of great interest to carry out periodic revisions to the preceptive documents of the plants as well as technique meetings for discussion of problems which may arise.

Regarding the inspections

1.- The diversity of technology used in the three plants, implies a great effort on the training of inspectors.
2.- It is considered as 6 the minimum number of yearly inspections for each plant, in normal operation conditions.

3.- It is necessary an Inspector in Charge responsible both for each plant and a group of specialized inspectors on several techniques.

4.- The training and up-to-date of inspectors' knowledge, are of a great importance and this implies a considerable effort.

5.- The interchange of experience, on an international basis, should be increased and therefore we believe that the meeting we are holding now is of a great value and importance.
ANNEX I

Minimum information to be contained in the monthly operation report:

Nuclear

a) Number of hours during which the reactor has been critical.
b) Number of times the reactor reached the critical stage.
c) Fuel burning degree
d) Estimated energy reserve.

Energy

a) Total time during which the alternator has been synchronized.
b) Gross thermal energy generated
c) Gross electric energy generated
d) Net electric energy generated
e) Load factor
f) Operation factor
g) Non-availability factor

Outages

a) Planned outages
b) Non-programmed outages
c) Duration of outages
d) Cause of the outages

Operation and maintenance

a) With reference to the systems and components planned to prevent or reduce the consequences of nuclear accidents.
b) List of abnormal occurrences
c) Summary of the chemical and radiochemical conditions in the plant's systems.
d) Results of the tests carried out and summary of same.

**Radioactive liquid wastes**

a) Activity, in curie, contained in each discharge and total discharged activity during the month.

b) Volume in m³ of each one of the discharges, of the dissolvent water per discharge and of the dilution water used during the month.

c) Average monthly concentration in μCi/cc at the discharge canal outlet.

d) Hour, date and value of the maximum concentration freed during the month at the discharge canal outlet.

e) Results of the isotope analyses.

**Gaseous wastes**

a) Total activity, in curie, discharged during the month, indicating separately the values corresponding to noble gases, activation gases, halogens and particles.

b) Hour, date and value of maximum activity freed during the month, expressed in curie/sec.

c) Results of the isotopic analyses carried out.

d) Total activity, in curie, of discharged tritium.

**Solid radioactive wastes**

a) Total volume in m³ of the solid wastes produced.

b) Activity, in curie, per package and total.

c) Type of wastes.

d) Type of packaging.

e) Date and location of storage.

**Radioactive surveillance inside and outside the plant**

a) Summary of the activities carried out.

b) Summary of the dose of exposure of the personnel belonging to the plant as well as outsiders, and summary of the operations which have required a special radiological control.
c) Equipment which has been in operation for surveillance purposes, indicating the dates and results of the last tests and calibrations of same.

Changes in personnel (hiring, resignation, etc.)
### Anexo II

#### INSPECCION DE CENTRALES NUCLEARES EN EXPLOTACION

**VIGILANCIA Y CONTROL DE LA C.N.**

**AÑO** ______ HASTA EL MES DE ________

### 1.- DATOS DE REFERENCIA

| SHA REFERENCIA (NU)/ | ________ |
| EMPLAZAMIENTO | ________ |
| EXPLOTADOR | ________ |
| TIPO REACTOR | ________ |
| POTENCIA TÉRMICA PROYECTO (Mw) | ________ |
| POTENCIA ELECTRICA BRUTA (Mw) | ________ |
| POTENCIA ELECTRICA NETA (Mw) | ________ |
| FECHA AUTORIZACION PREVIA | ________ |
| FECHA AUTORIZACION CONSTRUCCION | ________ |
| FECHA COMENZO CONSTRUCCION | ________ |
| DIRECCION PROYECTO | ________ |
| SPO CONTRATO | ________ |
| CONTRATANTES | ________ |
| INGENIERIA | ________ |
| OBRA CIVIL | ________ |
| MONTAJE MECANICO | ________ |
| MONTAJE ELECTRICO | ________ |
| FECHA IF PERMISO EXPLOTACION PROVISIONAL | ________ |
| FECHA CIF CRITICIDAD | ________ |
| FECHA IF ACOPLAMIENTO | ________ |
| FECHA OPERACION COMERCIAL | ________ |

### 2.- DATOS DE EVOLUCION

| FECHA PERMISO EXPLOTACION, VIGENTE: | ________ |
| CADUCO | ________ |
| POTENCIA MAX. TÉRMICA AUTORIZ (Mw) | ________ |
| POTENCIA MAX. ELECT. BRUTA (Mw) | ________ |
| LIMITES ADICIONALES AL PERMISO EXPLOTACION (FECHAS) | ________ |
| AUTOLIMITACIONES DEL EXPLOTADOR EN POTENCIA (RAZONES) | ________ |
| RECARGAS EFECTUADAS | ________ |
| TOTAL ELEMENTOS COMBUSTIBLES EXTRADOS | ________ |
| FECHA COMENZO CICLO ACTUAL | ________ |
| PLANES EXPLOTACION PREVISTOS (PARADAS O ARRANQUES) | ________ |

### 3.- INSPECCIONES

| FECHA | ACTA | MOTIVO |
| ________ | ________ | ________ |

### 4.- COMUNICACIONES ENTRE LA INSPECCION Y EL EXPLOTADOR

| FECHA | ORIGEN | CONTENIDO Y OBSERVACIONES |
| ________ | ________ | ________ |
1.- ESCRITOS ENTRE LA J.E.N. Y EL EXPLOTADOR

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6.- TRANSGRESIONES DECLARADAS O IDENTIFICADAS

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7.- VARIOS

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#### ACUMULACIONES

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#### DEFINICIONES (Véase IAEA-168 VIENA, 1974)

- **F.C.:** Factor de Carga es la relación entre la energía total producida en el periodo considerado y la que hubiera podido ser producida a la potencia autorizada (Pn).
- **F.D.:** Factor de Desactivación es el tiempo que ha estado desactivada al 1% total de horas en el periodo considerado.
- **F.I.F.:** Factor de Incapacidad es la relación entre la energía que se deja de producir y la Pn. (F.I.F. Programado, por recarga o reparación).
- **F.I.H.P.:** Factor de Incapacidad por otra causa.

* Referencia al final del año considerado desde la puesta en marcha.

### COMENTARIOS Y OBSERVACIONES

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#### TOTALES

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- **CAUSAS DE LA INCAPACIDAD:** A. Fatales; B. Error operativo; C. Recarga; D. Mantenimiento y reparación; E. Pruebas de sistemas; F. Entrenamiento operativo y examen; G. Limitaciones impuestas por la autoridad; H. Otros.

- **ABREVIATURAS:** D.N.P. Disparo no programado; D.R. Disparo programado; P.P. Parada programada; P.R. Reducción potencia.

**OBSERVACIONES**

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Nota: El documento parece ser una hoja de cálculo o informe técnico con datos de explotación de una planta nuclear. Los cálculos y notas se refieren a medidas de eficiencia y capacidad del sistema, así como a los parámetros de funcionamiento y mantenimiento. Las definiciones y abreviaturas se utilizan para clasificar diferentes tipos de paradas y causas de la incapacidad. Las observaciones al final están destinadas a registrar notas adicionales o interpretaciones de los datos presentados.
9.- DESECHOS RADIACTIVOS LIQUIDOS EVACUADOS AL MEDIO AMBIENTE POR LA C.N.

| AÑO |

**ACTIVIDAD EVACuada MENSUALMENTE**

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<th>MAXIMA (µCi/A)</th>
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**Observaciones**

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Formato IV 6  Rev. 11 Mayo 77
## 10. DESECHOS RADIOACTIVOS GASEOSOS EVACUADOS AL MEDIO AMBIENTE POR LA C.N.

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### OBSERVACIONES

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**Formato N°** Rev. II Mayo 77
11. -- DOSIMETRÍA DEL PERSONAL DE PLANTILLA Y CONTRATADO DE LA C.N.

AÑO __________

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OBSERVACIONES

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Formato IV1 Rev II Mayo 77
13.- CONCLUSIONES
ANNEX III

INFORMATION TO BE SUBMITTED TO JEN WITH REFERENCE TO REFUELING IN NUCLEAR POWER PLANTS

1. Two months before the foreseen date of the refueling operation

The plans foreseen for refueling will include:

- Fuel elements to be extracted.
- Characteristics of the new fuel elements, justifying any modification.
- Foreseen pattern of the new core.
- Calculation of the physical parameters of the core and comparison of the parameters obtained with regard to the previous cycle.
- Limits set for maximum and average core burnup, average burnup expected at the end of the cycle.
- In-service inspection program (pressure barrier and fuel).
- Repairs during shutdown.
- Preliminary program of critical path and estimated times.

2. Two weeks before refueling shutdown

Definite planning will include:

- Detailed development and modifications regarding point no. 1 above.
- Forecast of participation required by personnel not belonging to the power plant.
- Radiological load foreseen for all personnel who will take part in the work. Radiological control program.
- Control program to safeguard the installation's physical integrity.

3. During refueling

- Report of the abnormalities found during the inspection (fuel, pressure barrier, etc.).
- Report of possible abnormalities related to radiologic protection of the personnel.
4. Prior to approaching the critical stage and at least 48 hours before same starts

Concise preliminary reports on:

- Results of refueling inspection.
- Results of in-service inspection.

Before synchronization:

- Results of the parameter readings.

5. Three months after reaching full power

- Final report giving results and conclusions.
FIG. 1.—NUCLEAR POWER PLANT JOSE CABRERA.
NUMBER OF INSPECTIONS BY YEAR.
FIG. 2.—NUCLEAR POWER PLANT SANTA MARIA DE GARCÍA. NUMBER OF INSPECTIONS BY YEAR.
FIG. 3.-NUCLEAR POWER PLANT VANDELLOS.
NUMBER OF INSPECTIONS BY YEAR.
FIG. 4.—INSPECTION GROUP ORGANIZATION
OPERATIONAL EXPERIENCE IN THE UNITED KINGDOM

W S Gronow

Health and Safety Executive
Nuclear Installations Inspectorate
UNITED KINGDOM

In the UK there are 26 Magnox reactors and 4 AGRs operating on 11 licensed sites; a further 6 AGRs are under construction on 2 additional and one of the existing sites. This paper describes the arrangements by which the Nuclear Installations Inspectorate, on behalf of the Health and Safety Executive, carries out its regulatory functions at operating nuclear power plants. The range of activities undertaken is described with special reference being made to the biennial shutdowns for approved maintenance and inspections which are required by conditions attached to the site licence. The other means by which the continuing safety of these power reactors is assured are explained and include the relationship with the licensee's own Nuclear Safety Committee, approved arrangements for modifications to plant systems or components which have importance for safety and long term reviews of safety aspects.
INTRODUCTION

The main statutory basis for the safety control of nuclear installations in the UK is the Health and Safety at Work etc Act 1974 and the associated relevant statutory provisions of the Nuclear Installations Act 1965. The main types of installations covered by this legislature are nuclear power plants, nuclear fuel manufacturing and reprocessing plants and nuclear research facilities. No commercial nuclear installation may be built or operated without a licence granted by the Health and Safety Executive. Licence conditions in the interest of safety are imposed and enforced by the Executive's Nuclear Installations Inspectorate (NII) which exercises strict surveillance at all licensed sites. Sites operated by the United Kingdom Atomic Energy Authority and by Government Departments are not subject to licensing but are required under the 1965 Act to meet the same standards as are imposed on the operators of licensed sites. The operation of all these sites, licensed or not, is subject to the obligations imposed by the Health and Safety at Work Act.

The licensee is responsible for safety and the Health and Safety Executive have the responsibility for determining, enforcing and developing nuclear health and safety requirements. This extends to the assessment of measures being taken, or which might be considered necessary, to prevent injury and damage which might result from a nuclear accident or from any routine exposure to radiation. Control is exercised by means of the site licence conditions, which are enforced by the NII and which may be varied, or the licence itself revoked, at any time.

In the UK there are 26 Magnox reactors and 4 AGRs operating on 11 licensed sites, a further 6 AGRs are under construction. This paper discusses the arrangements by which the Nuclear Installations Inspectorate, on behalf of the Health and Safety Executive, carries out its regulatory functions and reviews the experience gained in applying safety controls at operating nuclear power plants.

2. NUCLEAR SITE LICENCES

Each nuclear licence contains conditions which by virtue of the powers granted to the Health and Safety Executive may bear on the siting, design, construction, installation, operation, modification and maintenance of any plant, as well as on general matters relating to radiological protection of personnel on the site, measures considered to be necessary to deal with any accident or emergency on or off the nuclear site, and the measurement of any radioactive materials that may be discharged from the site. These conditions can be legally enforced under statutory penalties and the flexibility of the licensing regime makes it possible to frame conditions appropriate for the protection of operators and the public from ionising radiations at the various stages of plant life for any of the licensed nuclear sites.

Once a plant has been constructed and commissioned the manner in which it will be operated is governed by the conditions of the nuclear site licence. A typical operating licence will have some 60 conditions in various schedules which also provide a description of the site and the plant, specify the maximum permitted doses of radiation and levels of contamination, and the maximum quantities of new and irradiated fuel allowed in containers or stores. These conditions cover every aspect of nuclear power station operation and a brief outline of some of the more important requirements during operation is given below.
3. LICENCE CONDITIONS DURING OPERATION

3.1 OPERATING RULES AND INSTRUCTIONS

Licence conditions require the licensee to specify plant operating rules and limits and provide instructions to implement the rules and limits. The rules and limits are derived from the safety analysis and from the results of the commissioning. The plant may not be operated outside these rules and limits and any change or suspension must be approved by a safety committee and the HSE.

The plant operating instructions must be submitted to the HSE before they come into force and any alteration must be reported within 14 days.

3.2 EXAMINATION, INSPECTION, MAINTENANCE AND TESTING

There is a requirement for the licensee to provide a scheme for the inspection, testing and maintenance of the nuclear plant by competent persons. The conditions specify many of the plant items which must be included in the scheme but the licensee is also required to submit for approval of the HSE a maintenance schedule for all safety related plant. This schedule is supplemented by maintenance instructions detailing the methods to be employed. These instructions are not formally approved by the HSE but they must be made available on the site for examination by regulatory staff.

The licensee is also required to carry out detailed inspections of the plant including an internal examination of the reactor during shut-down and for twin reactor stations one reactor must be shut down each year. It may not be started up without the consent of the HSE.

A further requirement is that the licensee should report any matter revealed by any examination or test which indicates that the safe operation or safe condition of the plant may be affected.

3.3 MODIFICATIONS TO THE PLANT

The control of modification to the plant requires the licensee to submit for approval of the HSE certain plans, designs and specifications relating to the plant. Once approved, plant covered by the drawings which mainly includes circuit diagrams and schedules of essential safety equipment, may not be modified before being submitted to a safety committee for approval and subsequent endorsement by the HSE. Any other modifications to the plant including pressure circuit components are subject to detailed procedures which provide for the approval of a safety committee and the HSE depending on their significance for the safety of the nuclear plant.

3.4 SAFETY COMMITTEE

The licensee is required to form a Committee of persons with suitable qualifications and experience for the purpose of performing any function assigned to it under any condition attached to the licence. In particular to consider any proposed alteration to the operating
rules, any experiments connected with the plant and any modification to the plant of safety significance with a view to advising the licensee upon the safety of such alterations, modifications or experiments.

3.5 RADIOLOGICAL PROTECTION

The conditions specify the limits to which persons may be exposed to radiation and the permissible levels of contamination of working areas on the plant. Arrangements must be made for monitoring and recording the radiation doses of all occupational exposed workers, measuring the radiation on the site and for discharges of radioactivity. Occupationally exposed workers must be medically examined and trained in the use of equipment and the licensee has a duty to minimise exposure. All cases of radiation exposure in excess of permitted limits must be investigated. In addition, the nuclear site is divided into radiation and contamination zones of degrees of severity. Entry into these controlled areas requires authorisation by competent persons and control of access must be provided.

3.6 REPORTING OF OCCURRENCES, INCIDENTS, ACCIDENTS AND OTHER INFORMATION

The mandatory requirements for reporting occurrences which might give rise to a significant radiological hazard to persons on or off the nuclear site or affect the safe working or condition of the nuclear plant as a result of an explosion or outbreak of fire are set out in the Dangerous Occurrences Regulations made under the Nuclear Installations Act 1965. Other occurrences, events and information which must also be reported to the HSE are detailed in the licence conditions and these are outlined below:

(i) Any occurrence which invokes any part of the emergency arrangements.

(ii) Any radiation exposure in excess of the permitted levels specified in the licence for both occupationally exposed persons and other persons on the site.

(iii) Excess levels of contamination and changes in controlled areas.

(iv) Loss of a radioactive substance which might cause undue exposure.

(v) Any defects or failures which might affect the safe working or safe condition of the plant.

(vi) The results of certain tests on the plant, reports on shutdown inspections and other examinations specified by the HSE.

(vii) Modifications to the plant of significance for safety.

The licensee is also required to report incidents of lesser significance which involve any release of radioactivity outside a controlled area or within a controlled area if special action or investigation is required, and other incidents which are of potential public interest.
3.7 RECORDING AND PRESERVING INFORMATION

A number of licence conditions require records to be kept on the nuclear site which must be made available to regulatory staff during inspection visits. These cover abnormal occurrences, defects and failures, investigations and inspections, radiological protection matters and operating information. There are various requirements on the preservation of the operating information but the general rule is that records must be kept for up to 30 years except in those cases where the information is subject to updating and this need only be kept for a period of 2 years.

3.8 STORAGE OF NUCLEAR FUEL

The licensee is required to keep nuclear fuel elements on the site in an approved store. The approval specifies the quantity, type of fuel and manner of storage and details of the storage arrangements for new fuel must be shown on drawings and posted in the store. Irradiated fuel is stored in cooling ponds and the approval specifies the form and quantity of storage.

3.9 WASTE MANAGEMENT

All waste storage facilities are approved by the HSE and the licensee must submit details of the arrangements for handling and treatment of waste arisings on the site. The submission must include details of all waste arisings, the treatment facilities and the procedures and controls provided to prevent any leakage or undue exposure of workers on the site.

Waste discharges or other disposals are only permitted under authorisations granted by the Government Environmental Departments under the Radioactive Substances Act 1960.

3.10 EMERGENCY ARRANGEMENTS

Arrangements must be made for dealing with any accident or emergency on the nuclear site and include provisions for: the measures which may be necessary to safeguard persons on or off the site; the supply of suitable equipment for monitoring levels of radiation or contamination; protective clothing, and at all times a means of communication for putting the arrangements into effect. The licensee must rehearse the emergency arrangements from time to time and ensure that appropriate training is given to operators on the site.

4. REGULATORY INSPECTIONS

There are 26 nuclear power reactors of the magnox type in operation and 4 Advanced Gas Cooled reactors in the later stages of commissioning in the UK subject to the inspection and licensing regime of the Nuclear Installations Act. The magnox reactors have between them accumulated over 350 years of operating experience at high load factors. During the past 15 years the Nuclear Inspectorate has carried out frequent inspections at each of the nuclear power stations and reviewed the
results of periodic and annual statutory examinations of the reactors and associated plant. The inspection visits embraced compliance with licence conditions, monitoring of operating records, surveillance and checks on operating and maintenance procedures and investigations of incidents, defects and failures at the plants. Special inspection visits were made during the biennial shutdown of reactors and following modifications to the plants which were of significance for safety, as well as for the annual rehearsals of the emergency plan.

In addition discussion were held with station managements over a wide range of topics in which the inspector applied his technical judgement to ensure that all potential safety problems were identified, assessed and reflected in the regulatory control of the installation. In these assessments full use was made of the range of expertise available with the Inspectorate and the independent inspection agencies appointed by the licensee.

5.1 REACTOR INSPECTIONS

The major specialist inspection effort is concerned with the requirement that a full and detailed examination of the reactors and boilers and shutdown systems demonstrate the satisfactory condition of each nuclear power plant for a further period of operation. The licensee is required to show that each reactor is safe to operate for at least two more years before start-up approval is given by the Executive.

In recent years experience has shown that the oxidation of mild steel components in the reactors may cause the more significant problems and the inspections during shutdown are dominated by this aspect. The environmental conditions within the reactors cause oxidation of the mild steel used for structural components. The rate of oxidation even in the hottest regions is very low but the oxide is adherent and forms on all surfaces including those between components in close contact causing strain on bolts, screws and welds which can lead to their failure. In addition small gaps can become filled with oxide and increase friction between sliding surfaces. Intensive studies have identified the main controlling parameters of the oxidation as: temperature; silicon content of the steel; hydrogen, moisture and carbon monoxide content of the gas; and gas pressure. The various relationships between these parameters are now well established and are used to predict the oxide thickness. Direct measurement is also possible by a number of methods, but is largely restricted to the annual inspection of specimens from within the pressure circuit. Empirical relationships have been developed to calculate from the oxide thickness data the failure probability of bolts and screws and the size of cracks at welds. When the predictions are significant in relation to the component duty and the safety aspects, special attention is paid to direct inspection of the component during the annual shutdown. In addition, studies are made of the consequence of premature failure.

Measurements of oxide thickness have so far been in general agreement with prediction except for some boiler welds at one station where oxide was typically twenty times thicker than predicted. The cause is still being sought but all similar boiler and reactor welds are inspected and so far have been shown to be in a satisfactory condition. Problems encountered during inspection of other reactors included misalignment of a recently installed core component which required
rectification by remote means; nut bursting because of oxidation; cracking of bellows, and broken thermocouple fastenings.

The discovery of the higher than expected rate of oxidation of mild steel components in magnox reactors and the potential problems associated with premature failure of components has required the Nuclear Inspectorate to develop in-house expertise in the assessment and inspection of the effects of oxidation on reactor and boiler components. In addition, the Inspectorate has initiated research by independent consultants on the mechanisms of oxidation and the behaviour of various steels in the reactor environment. Other consequences of the enhanced oxidation in the higher temperature regions of the reactors have been the reduction in reactor operating temperatures to a level which inhibits oxidation and the installation of additional shut-down devices consisting of boron balls which can be dropped into thimbles in the reactor.

5.2 PLANT INSPECTIONS

The range of inspection which must be carried out by competent persons appointed by the licensee are specified in the maintenance schedule. These include routine tests and inspections of all safety related equipment which may be carried out during normal operation or during the biennial shut-downs. Regulatory staff inspections are confined to sampling the work listed in the maintenance schedule unless a test or inspection reveals a problem that may be of significance for safety. There have been a number of such problems during the long period of operation of the magnox reactors and although only a few have required extensive remedial work or major design modifications they have all involved assessment and inspection effort from the regulatory inspection staff. In this category was the comparatively recent evidence of significant cracking in some internal component structural welds in the ducts and boilers at three stations. At none of these was there any evidence to show that the cracks had penetrated the boiler pressure vessel or gas duct walls. At one station cracks were found in external attachments to the ducts. A thorough investigation of the causes and likely future behaviour of the cracks was instituted and checks made on similar features at other stations. It was confirmed that in no case had cracks penetrated the duct walls or affected the pressure circuit integrity.

General inspections for each twin reactor station are carried out by a nominated inspector with a wide experience and knowledge of nuclear safety. This inspector is also responsible for the coordination of all specialist inspections as well as the compliance with the conditions of the nuclear licence. The main inspection duties are to maintain surveillance of all the operations on the nuclear plant and to make such check inspections as is deemed necessary to satisfy the Inspectorate that the licensee is meeting all the licence requirements, and any additional inspections of the plant or documentation that may be required as a result of abnormal occurrences, failures or defects in the nuclear plant. The designated site inspector is also required to progress any proposed changes in the operating rules or modifications to the plant and to coordinate any necessary safety assessment of such proposals. He is required to make reports of the results of inspection visits and provide a six monthly review of the operation of the plant including the results of all relevant tests and inspections. Following the biennial shut-down of each reactor on the nuclear station he submits a report summarising the results of the statutory examinations with explanatory comment on any
problems or exceptions to the approved schedules. The range of inspections covers many different technologies and the site inspector may request assistance or advice from specialist staff within the Inspectorate for any problem falling outside his competence. Under the Health and Safety at Work etc Act 1974 nuclear site inspectors have also been made responsible for the enforcement of industrial safety regulations but again when necessary they are able to call on specialist advice from staff with the Health and Safety Executive.

5.3 RADIOLOGICAL PROTECTION

The procedures and practices adopted for controlling radioactive exposure are fundamentally the same for all activities involving the use of ionising radiations but differ in detail according to the type and circumstances of the hazard. For instance, the problems posed by unsealed radioactive substances are quite different from those of sealed sources. For the latter protection is normally afforded by adequate shielding or by distance from the source whereas in the former it is also necessary to prevent contamination and ensure levels do not rise above acceptable values or that suitable protective equipment is worn. The detection and measurement of direct radiation is comparatively simple compared with techniques required to assess doses from radioactive substances in the body. There have been few incidents involving radiation exposure above permitted levels at nuclear power plants in the UK and the controls exercised by the licensees under the conditions of the licence have maintained very low radiation exposures for workers at the plants. Over 7,000 persons are employed as classified workers at nuclear power plants in the UK, less than 10% exceed doses greater than a whole body dose of 0.5 rem/yr, and only a small fraction of 1% of these persons are exposed to doses in excess of 1.5 rem/year, and there are only one or two cases of exposure slightly in excess of the annual limit of 5 rem. During normal working only a few contaminated areas require frequent access and again the controls have ensured that radiation doses from contamination are negligible. The controls exercised during plant shutdown and maintenance has also been effective and there are no recorded cases of significant exposure from contamination during these activities.

The designated site inspector carries out routine checks on the radiological protection provisions during operation and maintenance but specialist staff make periodic examinations of the working arrangements and equipment provided for detection of radiation and protection of workers at all licensed nuclear power plants.

5.4 WASTE MANAGEMENT

The radioactive waste stored on nuclear power station sites includes fuel element debris, reactor components and materials arising from the treatment of the spent fuel element cooling pond water. Other waste arises from the handling of contaminated equipment and operations on the plant, but this is usually of very low activity and can either be disposed of or reduced by incineration. The principle aim in the design of the storage facilities is that all waste should be safely contained and recoverable. It is of course necessary to provide suitable facilities for the temporary storage of irradiated fuel elements. This fuel is usually stored in ponds for a minimum period of 90 days before being transported to the fuel reprocessing plant. There is no particular
difficulty in designing suitable storage facilities at cooling ponds but wet storage does give rise to a further source of waste such as filter sludges and spent ion exchange resins.

In recent years some difficulties have been experienced with the storage of irradiated fuel at a number of nuclear power stations. For a variety of reasons dwell times in the cooling ponds have increased and when magnox fuel elements remain in water for long periods corrosion of the magnox cans may release soluble caesium from the fuel. This has increased the radioactivity of the cooling pond water and in some cases new treatment plants have been installed. At two stations the corrosion of the fuel elements had progressed further and corrosion products in the form of sludge containing the full range of isotopes from the irradiated fuel accumulated in the ponds. This sludge presents handling problems and pond clean up operations have been difficult and protracted.

The pond problems have called for significant regulatory inspection effort and in the safety assessment of the procedures for clean-up and storage of the additional waste arisings. Frequent checks are made on the waste storage facilities and the experience gained with handling and clean-up operations at the worst affected plants has been used to good effect at all licensed nuclear power plants.

Waste discharges from all nuclear installations in the UK are subject to authorisation granted by the Government Environmental Departments. The authorisations specify the type of waste, the means of disposal, the conditions which must be observed and the relevant measurements of the waste or environment which may be considered necessary. Discharge limits of liquid effluent are based on critical path analysis and gaseous discharges on best practical means. In practice the levels of discharge do not approach the permitted limits which are themselves set well below the acceptable levels. Appropriate monitoring programmes have been drawn up to provide checks on the effects of discharges on the environment. The responsibility for compliance and enforcement of the authorisations rests with the Environmental Departments but any inadvertent or unplanned discharge of gaseous or liquid waste would be investigated by the Nuclear Inspectorate since this might arise from incidents, defects or failures on the plant. Returns of waste discharges are also submitted to the Nuclear Inspectorate and close cooperation is maintained with the Environmental Departments.

5.5 **EMERGENCY ARRANGEMENTS**

The arrangements are provided in an Emergency Plan which is approved by the HSE. The plan sets out the general principles of the arrangements; the health physics procedures; action levels for evacuation of members of the public; the duties of the station staff; and the arrangements for notification and collaboration with outside bodies who may have duties under the plan. The plan is supplemented by a handbook which contains detailed information on every aspect of the operations involved in implementing the emergency arrangements. Any proposed changes in the plan must be approved by the HSE before implementation, but changes in the handbook which is subject to frequent updating on such matters as the particulars of individuals with duties in the plan are only required to be notified retrospectively.
The effectiveness of the emergency arrangements at each nuclear power plant is reviewed each year following a rehearsal of the plan based on a postulated accident to the plant which results in a release of radioactivity. The rehearsals are designed to test the feasibility and effectiveness of every aspect of the emergency arrangements and are witnessed by the Nuclear Inspectorate. The licencees are required to show that the station staff are adequately trained in their duties under the plan and that its organisation is fully prepared to meet an emergency. Rehearsals are also carried out outside normal working hours to test the communications and response to emergency call out procedures. Police, fire and other authorities cooperate in the annual demonstrations and the effectiveness of the evacuation arrangements has been tested to the point just short of actual evacuation of persons covered by the plan. The Nuclear Inspectorate field a team of observers at each rehearsal and the site inspector also witnesses training exercises given to individual groups with special duties such as damage control, fire fighting and first-aid. The plans have been modified over the years to take account of the experience gained in the rehearsals and developments in radiation monitoring techniques and although it is difficult to postulate every conceivable emergency that might arise the Inspectorate is generally satisfied that the emergency arrangements at licensed nuclear sites provides a basic response which should cater for all accidents.

6. **PLANT MODIFICATIONS AND CHANGES IN TECHNICAL SPECIFICATIONS**

The basic requirements are that any alterations to the plant of significance for safety or changes in the operating rules and limits derived from the design safety assessment and the results of commissioning must be given careful consideration by competent persons. This is achieved in practice by establishing a nuclear safety committee to consider such alterations or changes or any other matter on which the licensee might require advice. The committee members must be suitable persons with appropriate qualifications and experience and usually consists of senior staff in the licensee's organisation including the station manager and independent members with equivalent experience from other organisations such as the UK Atomic Energy Authority. Although a nuclear safety committee must be appointed for each nuclear site there are only three licensees and most of the persons appointed from within their organisations serve on each committee. This is also the case for the independent members. This arrangement has the advantage that the safety committees can take account of the safety problems on all nuclear power plants operated by one licensee and make general recommendations. In addition suitable liaison is maintained with safety committees appointed by other licensees.

The safety committees may regulate their own procedures and over the years a number of changes have been made on the procedures for approving plant modifications. Initially it was thought that modifications of safety significance would be covered by the plant drawings approved by the HSE and specific requirements concerning the pressure circuit. The approved drawings, which are actual working drawings included details of little or no significance for safety and the general requirements on the pressure circuit did not cover all the possible situations where modifications might introduce safety problems. The procedures for approving changes and the definitions of significant modifications have undergone extensive review over the years and at present a system
has been devised which permits minor modifications to be carried out without prior reference to the Committee but which also encompasses all possible situations where alterations might have a bearing on the safety of the nuclear plant. In some situations modifications are required to be made quickly if power operation is to continue and a special procedure has been introduced to cater for this possibility. In these circumstances approval may be obtained by consulting a quorum of members out of Committee and the Nuclear Inspectorate with the proviso that the action is fully recorded at the next full Committee meeting. The Nuclear Inspectorate carry out an assessment of all modifications or changes in operating rules or limits referred to the Safety Committee and no alterations can be made without a formal approval.

The work of the safety committees makes an important contribution to the safety of the nuclear plants. Apart from the duties assigned to them under the licence they provide a forum for discussion of the safety performance of all the nuclear power plants and advise the licencees on a wide range of problems. The reports of investigations into all significant occurrences are referred to them for information and comment as well as reviews of fault analyses carried out by the nuclear stations to take account of new experimental and operating data.

7. REPORTING OF DANGEROUS OCCURRENCES, ACCIDENTS AND FAILURES

The range of reporting requirements is outlined in Section 3 of the paper and although a number of occurrences have been classified as falling within the definition of the Dangerous Occurrences Regulations made under the Nuclear Installations Act 1965, none has involved a significant release of radioactivity on or off a nuclear power station site in the many years of operation of a large number of nuclear reactors. These occurrences have been so classified because they involved releases of carbon dioxide from the reactors which might have caused serious injury to persons on the site. This safety record reflects the care and attention given to the design construction and operation of nuclear plants. Nevertheless failures and accidents occur as they do on any complex plant and reactors suffer occasional unscheduled shut-downs from a wide range of causes such as fail safe faults on protective equipment, operator errors with subsequent automatic shut-down and faults on conventional plant. Each occurrence and faults or failures of safety significance must be recorded and certain of these events reported to the HSE in a prescribed manner.

It is difficult to devise a system of reporting for all possible events of interest to the regulatory body without making unreasonable demands on the licensees. In addition, licensees are reluctant to classify incidents as having safety significance if there is reasonable doubt. The present practice in the UK is to permit informal reports to be made of certain occurrences at nuclear sites without prejudice to their classification under the reporting arrangements. In this way prompt notification is made of unusual events and the Nuclear Inspectorate can take any action it may deem necessary.

In the context of public debate on nuclear power the requirements for reporting and publishing incidents at nuclear installations have recently been reviewed and with the cooperation of the licensees the HSE now publish a quarterly statement giving brief particulars of all occurrences and incidents reported under the Dangerous Occurrences
Regulations and the conditions attached to the nuclear site licence, as well as incidents of lesser significance or of potential public interest.

8. SAFETY REVIEWS

Some of the magnox nuclear power plants have now been operating for 20 years and most have been operating for over 10 years and although the designs are extremely conservative the ageing process and developments in technology may call for additional in depth reviews of the safety of continued operation as the plants approach the end of their design lives. The cost of replacement of certain components and increased maintenance may determine the actual life of the nuclear plants but the safety performance of certain irreplaceable items may also restrict operation. The requirements for replacement and maintenance should be reviewed as well as the adequacy of the safety provisions in the light of present day knowledge. Such reviews call for considerable effort by the regulatory body and the licensee. The plants are subject to continuing safety appraisals and inspections which gives confidence in their safety performance, nevertheless, reviews have been initiated in the UK with the object of identifying any necessary action in advance of its requirement.

9. SAFETY IN OPERATION

The conditions on which a nuclear site licence is issued are designed to ensure that all possible steps are taken to protect both the public and the operating staff from the risks arising in the operation of nuclear power plants. At all stages the Nuclear Inspectorate must be satisfied with the demonstration of the safeguards provided to prevent an escape of radioactivity or emission of ionising radiations. The scope of the conditions attached to nuclear site licences has been briefly discussed in the paper, but it should, however, be emphasised that these conditions are framed, as far as possible, to make sure that every aspect of the operation of the plant is properly thought out and put down in writing in advance. The Nuclear Installations Acts place the licensee under a strict duty to avoid harming anyone. The Health and Safety Executive has direct responsibility to ensure that all the necessary safety precautions are taken by the licensee and it is the task of the Nuclear Installations Inspectorate to ensure that the rules and regulations drawn up for this purpose are not only strictly observed, but that they are amended and brought up to date as experience dictates.
Inspection of licensed nuclear power plants in the United States is performed by the Office of Inspection and Enforcement (IE), United States Nuclear Regulatory Commission. IE has several key functions:

- Inspection of licensees and investigation of incidents, occurrences and allegations.
- Detection and correction of safety and security problems.
- Enforcement of rules, regulations, and Commission orders.
- Feedback to the industry and others regarding safety experience.
- Informing the public and others.

Major enforcement actions and events involving operating power reactors for the past several years will be summarized.
Inspection of licensed nuclear power plants in the United States is the responsibility of the United States Nuclear Regulatory Commission (NRC). This responsibility has in turn been delegated to the Office of Inspection and Enforcement (IE), which is one of the line offices in the NRC. (Slide 1) The Office of Nuclear Reactor Regulation (NRR) has the responsibility for issuing licenses and taking other licensing actions related to nuclear power plants. The Office of Nuclear Materials Safety and Safeguards (NMSS) has the responsibility for licensing all other nuclear facilities related to nuclear safety and safeguards.

IE has several key functions:

- Inspection of licensees and investigation of incidents, occurrences and allegations.
- Detection and correction of safety and security problems.
- Enforcement of rules, regulations, and Commission orders.
- Feedback to the industry and others regarding safety experience.
- Informing the public and others.

IE inspection embraces nuclear safety, radiation protection for the workers and the public, radiation waste disposal, plant protection, and environmental protection.

IE has five regional offices; Region I in Philadelphia, Region II in Atlanta, Region III in Chicago, Region IV in Dallas, and Region V in (Slide 2) San Francisco. IE Headquarters is located in Washington, D. C. (Bethesda, Maryland). The field inspection is performed in the regional offices and policy, program management, and technical guidance is supplied from Headquarters. Regions I, II, and III have the largest total staffs (~100 while Regions IV and V have total staffs of from 50 to 60 people). Headquarters has a total staff of ~100 people. In terms of inspectors and supervisors inspections of operating reactors the breakdown is as follows:

Region I 31
Region II 25
Region III 19
Region IV 5
Region V 9

The IE inspection program has two major components:

- Routine-preventive program.
- Nonroutine-reactive program.

**Inspection Program**

The routine preventive program is designed to provide a sampling of all of the major areas related to reactor safety and security to determine if the licensee's operations are adequate to protect the public health, safety and security and to determine if the licensee is operating in compliance with the Federal Rules and Regulations and with license requirements. Normally inspections are unannounced and are performed by teams of inspectors, including specialists in the various related disciplines. For many years the scheduled frequency of inspections has been four per year per facility. In practice the average approaches eight. The routine-preventive program is planned to consume approximately 80% of IE's inspection efforts for operating reactors.
The nonroutine-responsive program is designed to react to incidents, occurrences, and allegations which occur or are brought to the attention of the NRC. The objective is to determine what has happened, who may have been involved, the impact on public safety and security, what actions must be taken to correct the situation, enforce the Federal regulations and license conditions, feed information back to the industry and others (particularly if there is potential for a similar occurrence elsewhere), and to inform the public. This program is targeted to consume approximately 20% of IE's inspection efforts.

The IE inspection program is described in the IE Inspection Manual and includes the following areas:

- Reactor Operations
- Quality Assurance for Operations
- ECCS and Safety System Testing
- Management and Administrative Controls
- Inservice Inspection
- Maintenance and System Changes
- System Chemistry
- Radiation Protection
- Radiation Waste Disposal
- Environmental Monitoring
- Physical Security

An index to the specific inspections procedures for operating reactors in the IE Manual is presented in Enclosure 1. Each inspector has at least 20% of his time free to look into areas of his choosing in search of safety problems. (Slide 3)

The program for enforcement of operating reactors is performed in accordance with general IE enforcement procedures as described in another NRC paper. A summary of enforcement experience will be discussed below.

We are currently moving toward a change in the NRC inspection program - assignment of resident inspectors at each reactor site. When the program is fully implemented in the calendar year 1981 at least one resident IE inspector will be assigned to each licensed power reactor site where significant construction activities have begun or where reactor operations are underway. Resident inspectors will also be assigned to other types of major licensed nuclear facilities.

We intend to assign resident inspectors at eight sites by October 1, 1977 and move forward in stages to the goal of full implementation by calendar year 1981. Needless to say, this entails major planning and implementation efforts. These efforts are now underway.

The goal is to provide greater safety assurance by placing resident inspectors on-site to provide greater independent verification that licensees are conducting their operations in compliance with requirements and without undue risk to the public. The resident inspectors at operating nuclear power plants will observe reactor operations, radiation protection activities, environmental protection activities, quality assurance activities, and plant protection activities.

Specialists from the Regional offices will continue to perform technical evaluations of the licensee's programs in the areas outlined above. The resident inspectors will report to the Regional offices.
Special Performance Audit Teams from IE Headquarters will perform annual inspections to evaluate licensee performance with a focus on licensee management level at the site and at the corporate level. These teams will also evaluate the effectiveness of the Regional tandem of resident inspectors and teams of Regional specialists. Resident inspectors will be rotated periodically to help insure inspector objectivity.

Increased safety assurance will also be provided by an increased emphasis on independent measurements by IE personnel and contractors and by increased independent evaluation by IE personnel. Studies are now underway in these areas.

The above program developments underway are the product of the IE Study instituted by Dr. Volgenau, Director, Office of Inspection and Enforcement. The study is broad and aimed at focusing sharply on IE goals improving IE effectiveness. The IE Study will be discussed more fully by Dr. Volgenau.

Operating Experience

NRG operating reactor inspection experience can be summarized by considering the following factors:

- Amount of inspection effort expended.
- Results of inspections and enforcement actions taken.

We are presently studying methods for evaluation of licensee and IE performance using the available data and information on a more systematic basis.

As indicated above, we presently have approximately 100 inspectors involved in the performance of inspections of 65 operating reactors in the United States. In FY 1977, we performed 1,356 inspections with those resources. Of those 1,356 inspections, noncompliance was found during 608. This data is summarized for FY 1975, 1976, 1977 in the enclosed Table 1. (Slide 4)

Table 1 also contains a summary of enforcement results of severity of items of noncompliance. Violations are those items of noncompliance where significant safety consequences occurred or could have occurred because of the noncompliance. Infractions are those items of noncompliance where significant consequences could have occurred, but where safety margins (of protective systems) still existed. Deficiencies are items of noncompliance that do not have direct safety significance. Major enforcement actions involving operating power reactors is shown in Table 2. (Slide 5)

Licensees are required to report incidents, abnormal occurrences, and related events in accordance with their license requirements. These events have a wide range of severity.

The more significant matters are designated as abnormal occurrences. Requirements for reporting Abnormal Occurrences (AOs) are established in Section 208 of the Energy Reorganization Act of 1974, as amended. The primary points provided in this section are as follows:

1. An AO is defined as "an unscheduled incident or event which the Commission determines is significant from the standpoint of public Health and safety."
2. The format and general content of the AO reports are established by specifying that each report shall contain:
   a. The date and place of each occurrence.
   b. The nature and probable consequence of each occurrence.
   c. The cause or causes.
   d. Any action taken to prevent recurrence.

3. Directs the Commission to report AOs to Congress each quarter.

4. Directs the Commission to disseminate sections a and b to the public within fifteen (15) days after receiving information of an AO.

5. Directs the Commission to disseminate sections c and d to the public as soon as such information becomes available.

Interim criteria for determination of AOs were approved in September, 1975 and the first Report to Congress covering the first six months of 1975 was approved by the Commission in October, 1975. Revised "permanent" criteria were approved on February 8, 1977, and published in the Federal Register on February 24, 1977. The Fourth Quarter, 1976 Report to Congress was the first report formulated using the revised criteria.

The criteria state "an event will be considered an AO if it includes a major reduction in the degree of protection of the public health or safety."

Table 3 is a listing of Abnormal Occurrences reported to Congress as required by law. (Slide 6)

The NRC requires power reactor licensees to submit periodic reports regarding safety, security, and environmental matters. The NRC also requires that licensees report unusual occurrences, other matters, events, conditions, or occurrences that impact directly or indirectly on public safety, safeguards, and environmental protection.

The timing requirement for routine periodic reports ranges from yearly to monthly. The timing of Licensee Event Reports ranges from immediate to 30 days. NRC reporting requirements are compiled in NRC Regulatory Guide 10.0, Compilation of Reporting Requirements for Persons Subject to NRC Regulations.

Plant technical specifications include a section on reporting requirements detailing the types of events that should be reported (a) as expeditiously as possible (within 24 hours) or (b) within 30 days. The data from these reports are stored in the Commission's License Event Report (LER) File for further analysis and evaluations and public dissemination. In general the reporting requirements for these two types of events may be briefly summarized as follows:

Prompt notification:

(1) Failure of the reactor protection system or other systems subject to limiting safety-system settings to initiate the required protective function by the time a monitored parameter reaches the setpoint specified in the technical specifications or failure to complete the required protective function.
Operation of the unit or affected systems when any parameter or operation subject to a limiting condition for operation is less conservative than the least conservative aspect of the limiting condition for operation established in the technical specifications.

Abnormal degradation discovered in fuel cladding, reactor coolant pressure boundary, or primary containment.

Reactivity anomalies involving disagreement with the predicted value under steady-state conditions during power operation greater than or equal to 1% \( \Delta k/k \); a calculated reactivity balance indicating a shutdown margin less conservative than specified in the technical specifications; short-term reactivity increases that correspond to a reactor period of less than 5 seconds or, if subcritical, an unplanned reactivity insertion of more than 1.5% \( \Delta k/k \); or occurrence of any unplanned criticality.

Failure or malfunction of one or more components which prevents or could prevent, by itself, the fulfillment of the functional requirements of system(s) used to cope with accidents analyzed in the SAR.

Personal error or procedural inadequacy which prevents or could prevent, by itself, the fulfillment of the functional requirements of systems required to cope with accidents analyzed in the SAR.

Conditions arising from natural or manmade events that, as a direct result of the event, require plant shutdown, operation of safety systems, or other protective measures required by technical specifications.

Errors discovered in the transient or accident analyses or in the methods used for such analyses as described in the safety analysis report or in the bases for the technical specifications that have or could have permitted reactor operation in a manner less conservative than assumed in the analyses.

Performance of structures, systems, or components that require remedial action or corrective measures to prevent operation in a manner less conservative than that assumed in the accident analyses in the safety analysis report or technical specification bases; or discovery during plant life of conditions not specifically considered in the safety analysis report or technical specifications that require remedial action or corrective measures to prevent the existence or development of an unsafe condition.

Thirty Day Reports:

Reactor protection system or engineered safety feature instrument settings which are found to be less conservative than those established by technical specifications but which do not prevent the fulfillment of the functional requirements of affected systems.

Conditions leading to operation in a degraded mode permitted by a limiting condition for operation, or plant shutdown required by a limiting for operation.
(3) Observed inadequacies in the implementation of administrative or procedural controls which threaten to cause reduction of degree of redundancy provided in reactor protection systems or engineered safety feature systems.

(4) Abnormal degradation of systems designed to contain radioactive material resulting from the fission process.

The safety significance of LER's range from that of the events reported to the Congress as unusual Occurrence Reports to LER's dealing with reports of drifting set points. LER experience for the calendar years 1974 and 1975 has been reported in detail in NUREG-0227, Nuclear Power Plant Operating Experience 1974-1975.

For calendar year 1976 LER experience can be summarized as indicated in the attached Tables 4, 5, and 6.

In calendar year 1976, 2,531 LER's were reported involving 64 operating reactors. The total number of LER's reported by calendar year since 1969 is shown in the attached Table 7. LER information for calendar year 1976 is further summarized in Tables 7, 8, and 9 as indicated above.

Examination of the published LER data for calendar years 1974 and 1975 referenced above and the LER data for other years indicates a general consistency from year to year in terms of reported cause and systems involved.

Reactor operating experience in the United States has been good in the sense that the number of incidents and occurrences with consequences has been low and the extent of consequences has also been low. As a regulator, it is not my job to expound on the state of the industry. It is my job, however, to call for unceasing vigilance and good performance on the part of the licensees.
UNITED STATES NUCLEAR REGULATORY COMMISSION
OFFICE OF INSPECTION AND ENFORCEMENT
REGIONAL OFFICES

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**INSPECTION PROCEDURES, LIGHT WATER REACTORS - OPERATIONS PHASE**

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<td>Management Meetings - As Needed and 3 Years</td>
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<td>Management Meeting - Entrance and Exit Interviews</td>
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<td>35701B</td>
<td>QA Program - Annual Review</td>
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<td>Design, Design Changes and Modifications</td>
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*When required

*Eligible for conduct at reduced frequency

2515 E1-1
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- When required
- Eligible for conduct at reduced frequency
- Refueling

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<td>90740B</td>
<td>Review of Containment Leak Rate Testing Report - IILRT</td>
<td>W +</td>
</tr>
<tr>
<td>90741B</td>
<td>Review of Containment Leak Rate Testing Report - Type B &amp; C Tests</td>
<td>W +</td>
</tr>
<tr>
<td>92700B</td>
<td>Licensee Event Followup</td>
<td>W +</td>
</tr>
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*+When required
**As scheduled by licensee or technical specifications
<table>
<thead>
<tr>
<th>Inspection Procedure Number</th>
<th>Title</th>
<th>Inspection Frequency</th>
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<tbody>
<tr>
<td>92701B</td>
<td>Followup on Inspector-Identified Problems Unresolved Items</td>
<td>W +</td>
</tr>
<tr>
<td>92702B</td>
<td>Followup on Items of Noncompliance/Deviations</td>
<td>W +</td>
</tr>
<tr>
<td>92703B</td>
<td>IE Bulletin/Circular/Immediate Action Letter Followup</td>
<td>W +</td>
</tr>
<tr>
<td>92704B</td>
<td>Followup on Headquarters Requests</td>
<td>W +</td>
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<tr>
<td>92705B</td>
<td>Followup on Regional Requests</td>
<td>W +</td>
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<tr>
<td>92706B</td>
<td>Independent Inspection Effort</td>
<td>Each Inspection</td>
</tr>
<tr>
<td></td>
<td>Followup on Licensee's Plans for Coping with Strikes</td>
<td>W +</td>
</tr>
<tr>
<td>92709B</td>
<td>Followup on Initial Licensee Implementation of Strike Plan</td>
<td>W +</td>
</tr>
<tr>
<td>92710B</td>
<td>Followup on Continued Licensee Implementation of Strike Plans During an Extended Strike</td>
<td>W +</td>
</tr>
<tr>
<td>92712B</td>
<td>Followup on Resumption of Normal Operations After a Strike</td>
<td>W +</td>
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+When required
<table>
<thead>
<tr>
<th>Inspection Procedure Number</th>
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<th>Inspection Frequency</th>
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<tbody>
<tr>
<td>93700B</td>
<td>Inspector Dispatched to Site</td>
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<tr>
<td>93701B</td>
<td>Followup on Significant Event that Occurs During Inspection</td>
<td>W +</td>
</tr>
<tr>
<td>94700B</td>
<td>Participation in ACRS Meetings</td>
<td>W +</td>
</tr>
<tr>
<td>94701B</td>
<td>Recommendations Regarding License Modification</td>
<td>W +</td>
</tr>
<tr>
<td>94702B</td>
<td>Participation in NRR/Licensee Meeting</td>
<td>W +</td>
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<tr>
<td>62701B</td>
<td>Maintenance</td>
<td>Refueling</td>
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<tr>
<td>63700B</td>
<td>Construction Testing</td>
<td>W+</td>
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<tr>
<td>70700B</td>
<td>Preoperational Testing</td>
<td>W+</td>
</tr>
<tr>
<td>71710B</td>
<td>Review of Plant Operations</td>
<td>Q</td>
</tr>
<tr>
<td>71711B</td>
<td>Review of Plant Operations</td>
<td>Each Refueling</td>
</tr>
<tr>
<td>71712B</td>
<td>Review of Plant Operations</td>
<td>After Each Refueling</td>
</tr>
<tr>
<td>72700B</td>
<td>Startup Testing - Refueling</td>
<td>Each Refueling</td>
</tr>
<tr>
<td>72701B</td>
<td>Startup Testing - New or Modified System</td>
<td>W+</td>
</tr>
<tr>
<td>73051B</td>
<td>Inservice Inspection - Review of Program</td>
<td>Tech/Spec</td>
</tr>
<tr>
<td>73052B</td>
<td>Inservice Inspection - Review of Procedures</td>
<td>Tech/Spec</td>
</tr>
<tr>
<td>73753B</td>
<td>Inservice Inspection - Observation of Work and Work Activities</td>
<td>Tech/Spec</td>
</tr>
<tr>
<td>73755B</td>
<td>Inservice Inspection - Data Review and Evaluation</td>
<td>Tech/Spec</td>
</tr>
<tr>
<td>80710B</td>
<td>Environmental Protection</td>
<td>A *</td>
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*When required
*Eligible for conduct at reduced frequency
<table>
<thead>
<tr>
<th>Inspection Procedure Number</th>
<th>Title</th>
<th>Frequency</th>
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<tr>
<td>81100B</td>
<td>Physical Protection</td>
<td>A</td>
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<tr>
<td>81300B</td>
<td>Physical Protection - SNM in Transit</td>
<td>W*</td>
</tr>
<tr>
<td>82710B</td>
<td>Emergency Planning - Agreements &amp; Coordination with Offsite Agencies</td>
<td>A*</td>
</tr>
<tr>
<td>82711B</td>
<td>Emergency Planning - Facilities &amp; Equipment</td>
<td>A*</td>
</tr>
<tr>
<td>82712B</td>
<td>Emergency Planning - Test &amp; Drills</td>
<td>A*</td>
</tr>
<tr>
<td>83740B</td>
<td>Radiation Protection - Operation</td>
<td>A*</td>
</tr>
<tr>
<td>83745B</td>
<td>Radiation Protection - Refueling</td>
<td>W*</td>
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<tr>
<td>84710B</td>
<td>Radioactive Waste Systems, Operation</td>
<td>A*</td>
</tr>
<tr>
<td>84711B</td>
<td>Radioactive Waste Systems, QC and Confirmatory Measurement</td>
<td>A*</td>
</tr>
<tr>
<td>85102B</td>
<td>Material Control &amp; Accounting - Facility Organization and Operation</td>
<td>3 years</td>
</tr>
<tr>
<td>85104B</td>
<td>Material Control &amp; Accounting - Measurement and Controls</td>
<td>3 years</td>
</tr>
<tr>
<td>85106B</td>
<td>Material Control &amp; Accounting - Shipping and Receiving</td>
<td>3 years</td>
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<tr>
<td>85108B</td>
<td>Material Control &amp; Accounting - Storage and Internal Control</td>
<td>3 years</td>
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+ When required
*Eligible for conduct at reduced frequency
<table>
<thead>
<tr>
<th>Year</th>
<th>Operating Reactors</th>
<th>Violations</th>
<th>Infractions</th>
<th>Deficiency</th>
<th>Inspections Clear</th>
<th>Not Clear</th>
<th>Total</th>
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<tbody>
<tr>
<td>FY 1976</td>
<td>(B2 &amp; C)</td>
<td>7</td>
<td>721</td>
<td>.527</td>
<td>.613</td>
<td>.528</td>
<td>1141</td>
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<tr>
<td>FY 1977</td>
<td></td>
<td>2</td>
<td>796</td>
<td>380</td>
<td>748</td>
<td>1356</td>
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<tr>
<td>FY 1975</td>
<td></td>
<td>8</td>
<td>784</td>
<td>320</td>
<td>463</td>
<td>380</td>
<td>843</td>
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**NOTE:** FY 1977 July 76 thru May 77

Totals for reactors on summary sheets equal these B2&C Power Reactors plus AO, etc. Research, Test, Deactivated PWR Reactors
HQ ENFORCEMENT ACTION FOR POWER REACTORS IN 1976 & 1977

1) Baltimore Gas & Electric
   Calvert Cliffs 1, (50-317), HQ letter 5/5/77 (3/14/77)

2) Carolina Power & Light
   Brunswick 2, (50-324), Civil Penalty 2/18/76

3) Commonwealth Edison
   Dresden 1,2,3 (50-10, 237, 249), Notice 8/19/76 (6/16/76)
   Zion 1 (50-295), Civil Penalty 5/25/76 (3/22/76)
   Dresden 2 (50-237), Notice 6/14/77 (2/28/77)

4) Consolidated Edison
   Indian Point 1,2,3 (50-03, 247, 286), HQ letter 1/14/77 (10/20/76)
   Indian Point 2 (50-247), Civil Penalty 6/21/76 (4/6/76)

5) Consumers Power Co. of Mich.
   Palisades (50-255), Notice 4/23/76 (2/27/76)

6) Duke Power
   Oconee 1,2,3 (50-209, 270, 287), Civil Penalty 3/29/77 (12/20/76)

7) Jersey Central Power & Light
   Oyster Creek (50-219), Civil Penalty 6/28/76

8) Metropolitan Edison
   Three Mile Island 1, (50-289), Civil Penalty 3/15/76 (2/5/76)

9) Niagara Mohawk Power
   Fitzpatrick (50-333), Civil Penalty 7/16/76

10) Northeast Nuclear
    Millstone Point 1, (50-245), Civil Penalty 1/21/77 (11/12/76)

11) Northern States Power
    Monticello (50-263), Notice 6/14/77 (2/17/77)

12) Pacific Gas & Electric
    Humboldt Bay (50-133), Civil Penalty 5/16/77 (3/7/77)

13) Public Service of Colorado
    Fort St. Vrain (50-267), Civil Penalty 5/11/77 (4/18/77)

14) Tennessee Valley Authority
    Browns Ferry 1 & 2 (50-259, 260), HQ letter 6/8/76 (5/6/76)

15) Virginia Electric & Power
    North Anna 1 & 2 (50-338, 339), Civil Penalty 12/6/76 (8/13/76)
<table>
<thead>
<tr>
<th>Date</th>
<th>Event Type</th>
<th>Event</th>
<th>Facility</th>
</tr>
</thead>
<tbody>
<tr>
<td>February 26, 1975</td>
<td>Single</td>
<td>Steam Generator Tube Failure (Update: NUREG-0090-1 Appendix B-1 July - Sep '75)</td>
<td>Point Beach 1</td>
</tr>
<tr>
<td>March 22, 1975</td>
<td>Single</td>
<td>Fire in Electrical Cable Trays (Updates: NUREG-0090-1 Appendix B-2 July - Sep '75, NUREG-0090-3 Appendix B pgs 13 &amp; 14 Jan - March '76, NUREG-0090-4 Appendix B pg 8 April 1 - June '76)</td>
<td>Browns Ferry 1 &amp; 2</td>
</tr>
<tr>
<td>May 1, 1975</td>
<td>Single</td>
<td>Loss of Main Coolant Pump Seals (Update: NUREG-0090-1 Appendix B-3 July - Sep '75)</td>
<td>H. B. Robinson 2</td>
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<tr>
<td>January 25, 1975 and May 3, 1975</td>
<td>Recurring</td>
<td>Improper Control Rod Withdrawals-Maintenance (Update: NUREG-0090-1 Appendix B-4 July - Sep '75)</td>
<td>Dresden 2, Quad-Cities 1</td>
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<tr>
<td>Various: September '74 Generic to January, 1975</td>
<td></td>
<td>Cracks in Pipes at Boiling Water Reactors (Updates: NUREG-0090-2 Appendix B-1 &amp; B-2 Oct - Dec '75, NUREG-0090-3 Appendix B pg 14 Jan - March '76)</td>
<td>Dresden 2, Quad-Cities 1, Millstone 1, Monticello, and Peach Bottom 3</td>
</tr>
<tr>
<td>April, 1975</td>
<td>Generic</td>
<td>Fuel Channel Box Wear at Boiling Water Reactors</td>
<td></td>
</tr>
<tr>
<td>Various: October 1972 Generic to May 1975</td>
<td></td>
<td>Steam Generator Feedwater Flow Instability at Pressurized Water Reactors (Updates: NUREG-0090-1 Appendix B-8 July - Sep '75, NUREG-0090-6 Appendix B pgs 18-19 Oct - Dec '75)</td>
<td>Surry 1, Turkey Point 3 &amp; 4, Indian Point 2, &amp; Calvert Cliffs 1</td>
</tr>
</tbody>
</table>

(Note: For the recurring and generic events, the circumstances surrounding the events varied from plant to plant.)
<table>
<thead>
<tr>
<th>Date</th>
<th>Event Type</th>
<th>Event</th>
<th>Facility</th>
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<tbody>
<tr>
<td>January, 1976</td>
<td>Generic</td>
<td>76-1 Deficiencies in the 'Mark I' Containment Systems</td>
<td>See List 76-1 pg 1 &amp; 2, NUREG-0090-6</td>
</tr>
<tr>
<td></td>
<td></td>
<td>of Certain Boiling Water Reactors</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>(Updates: NUREG-0090-4 April - June '76 pg 8</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>NUREG-0090-6 Oct - Dec '76 pg 19)</td>
<td></td>
</tr>
<tr>
<td>March 18, 1976</td>
<td>Single</td>
<td>76-2 8 Rem Occupational Whole Body Exposure</td>
<td>Zion Unit 1</td>
</tr>
<tr>
<td>April 5, 1976</td>
<td>Single</td>
<td>76-6 10 Rem Occupational Whole Body Exposure</td>
<td>Indian Point Unit 1</td>
</tr>
<tr>
<td>July 5 &amp; 21, 1976</td>
<td>Single</td>
<td>76-9 Failure of Undervoltage Trip Logic and Consequent Loss of</td>
<td>Millstone Unit 2</td>
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<tr>
<td></td>
<td></td>
<td>Safeguard AC Power</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>(Update: NUREG-0090-6 Oct - Dec '76, pg 20)</td>
<td></td>
</tr>
<tr>
<td>July 8, 1976</td>
<td>Single</td>
<td>76-10 Nuclear Core Power Distribution Anomaly</td>
<td>St. Lucie Unit 1</td>
</tr>
<tr>
<td>September 15, 1976</td>
<td>Single</td>
<td>76-11 Steam Generator Tube Integrity</td>
<td>Surry Unit 2</td>
</tr>
<tr>
<td>November 12, 1976</td>
<td>Single</td>
<td>76-15 Improper Control Rod Withdrawals and Unplanned Reactor</td>
<td>Millstone Unit 1</td>
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<tr>
<td></td>
<td></td>
<td>Criticality</td>
<td></td>
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<tr>
<td>December, 1976</td>
<td>Generic</td>
<td>76-16 Feedwater Nozzle Cracking in Boiling Water Reactors</td>
<td>See List 76-16, pg 3, NUREG-0090-6</td>
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<td></td>
<td></td>
<td>(Update: NUREG-0090-7, Jan-Mar '77 pg 7)</td>
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## TABLE 4
Reactor LER's by Event Year

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<tr>
<th>Year</th>
<th>LER</th>
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<tr>
<td>1969</td>
<td>44</td>
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<tr>
<td>1970</td>
<td>88</td>
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<tr>
<td>1971</td>
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<tr>
<td>1972</td>
<td>446</td>
</tr>
<tr>
<td>1973</td>
<td>896</td>
</tr>
<tr>
<td>1974</td>
<td>1566</td>
</tr>
<tr>
<td>1975</td>
<td>2198</td>
</tr>
<tr>
<td>1976</td>
<td>2531</td>
</tr>
<tr>
<td>System</td>
<td>Per Cent of Reports</td>
</tr>
<tr>
<td>-------------------------------------------</td>
<td>---------------------</td>
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<tr>
<td>Engineered Safety Features</td>
<td>22.2</td>
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<tr>
<td>Reactor Coolant Systems and Connected Systems</td>
<td>17.6</td>
</tr>
<tr>
<td>Instrumentation and Control Systems</td>
<td>15.0</td>
</tr>
<tr>
<td>Electric Power Systems</td>
<td>9.6</td>
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<tr>
<td>Reactor Systems</td>
<td>6.2</td>
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<tr>
<td>Cause</td>
<td>Per Cent of Reports</td>
</tr>
<tr>
<td>-------------------------------</td>
<td>---------------------</td>
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<tr>
<td>Component Failure</td>
<td>51.0</td>
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<tr>
<td>Personnel Error</td>
<td>16.4</td>
</tr>
<tr>
<td>Design/Fabrication Error</td>
<td>9.4</td>
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<tr>
<td>Defective Procedures</td>
<td>6.3</td>
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<tr>
<td>External Cause</td>
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<tr>
<td>Other</td>
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<tr>
<td>Plant Status</td>
<td>Per Cent of Reports</td>
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<td>------------------------------</td>
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<tr>
<td>Steady State Operation</td>
<td>39.4</td>
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<tr>
<td>Routine Test or Inspection</td>
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<td>Special Test or Inspection</td>
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<tr>
<td>Other</td>
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</tr>
</tbody>
</table>
IN-SERVICE INSPECTION - PRESSURE TEST OF THE PRIMARY CIRCUIT OF THE CHOOZ NUCLEAR POWER PLANT

F.L. BARTHELEMY, Direction des Mines
97, Rue de Grenelle - 75007 PARIS (France)

P.G. LESPIAUCQ, IPSN/DSN/SESP - C.E.A.
CEN/FAR - B.P. n° 6 - 92260 FONTENAY-aux-ROSES (France)

SUMMARY

A brief summary is given of the regulations governing inspection practices of operating nuclear power plants, in France. As an example, such an inspection performed in 1976 on the Westinghouse 320 MWe PWR built in CHOOZ (Ardennes) is described. Emphasis is put on the administrative organization, the technical solutions, the specific problems and the difficulties encountered.

SUROMAIRE

Sont exposés de façon résumée les aspects réglementaires de l'inspection en service des centrales nucléaires de puissance. Une inspection conduite en 1976 sur la centrale de 320 MWe PWR construite à CHOOZ (Ardennes) par Westinghouse est décrite, à titre d'exemple, en mettant l'accent sur l'organisation administrative, les solutions techniques, les problèmes spécifiques et les difficultés rencontrées.
In France, the in-service inspection of the primary coolant pressure boundary of PWR nuclear plants is governed by the "Arrêté" of 02.26.1974.

The part of this text dealing with the in-service inspection envisages two types of visits:

a) the major ones, called the complete visits and including a pressure test, which are performed:
   - the first one thirty months after the first core loading,
   - the following every ten years after this first one.

b) the partial ones, according to the paragraph requiring that the operator shall have the components inspected as often as necessary, the interval between two tests not being longer than two years. This implies, in fact, a partial inspection at every annual maintenance and refuelling outage.

It is to be noted that all the inspections are performed by the operator himself, under the supervision of the local Division of the Administration (Service Interdépartemental de l'Industrie et des Mines).

Emphasis must be placed on the importance of these complete inspections. Their aim is to bring to light any alteration undergone by the equipment which would be prejudicial to its safety. The owner must therefore use all available technical resources, at the time of the test, to fulfill this aim. It is desirable that the methods employed enable all defects to be revealed which are not explicitly tolerated in the fabrication specifications documents. Their implementation will lead, for example, to the visual inspection of wall surfaces by television with video-tape recording, or inspection of welded joints, complex shaped or stress concentration zones and mechanical assembly components by ultrasonics (normal and/or focused detectors) with data recording and processing, by die-penetrant inspection or by eddy-currents. Remote-control devices have been specially developed for such inspections. Of course, effort has to be devoted to shortening (in this saving man-rem and outage time) and decreasing cost of the inspection without impairing its effectiveness.

The complete inspection certificate shall not only include the results of these visits and checks but also show that the design and fabrication provisions and specifications are always met according to the regularity requirements.

It has to be pointed out that the regulation allows the operator taking into consideration the results obtained during the partial visits performed during the 24 months before the complete inspection, thus permitting to spread important parts of the inspection over two to three annual outages.

In addition, the discussion attached to the regulation reminds the applicant that every precaution should be taken so that examinations and measurements to be made during the renewed hydrostatic test can be carried out without endangering the personnel. It is also recommended that such a test be conducted only after having removed, where necessary, the radioactive materials contained in the system to be tested.
This regulation on in-service inspection of the primary coolant pressure boundary published in February 1974 has been applied at the first time at the CHOOZ nuclear power plant. It is a Franco-Belgian PWR, 4-loops Westinghouse type, rating 1040 MWth, delivering steam to a 320 MWe turbogenerator. The inspection was made during the annual outages in 1974, 1975 and 1976. The complete inspection including the pressure test has been performed in 1976.

As the reactor was designed more than ten years before issuing the actual regulation, provisions were to be made to accommodate this old design with regularity requirements and performance of visits not envisaged originally. As for example:

- the regulation applied during the construction phase was not requiring a lot of inspections necessary to define the reference state of the circuit. As it was found in good condition after ten years operation, this difficulty was not considered as a major one.

- the in-core instrumentation, mainly the aeroball flux distribution measuring system was not designed to sustain the stresses induced by the primary water flow without being maintained in position by the guide tubes of the fuel elements. This has obliged the operator to provide core dummy model to protect the in-core instrumentation during the running of the primary pumps necessary to keep the circuit temperature at the adequate level over the NDTT.

- in addition, as the reactor experienced a failure of internals after six months operation, the annual inspection includes a visit of these internale which has to be made in the reactor pool where they are directly stored without any other shielding than water. As this pool had to be emptied for the reactor vessel inspection, a special shielding had to be provided to protect the workers against the radiation emitted by these internals.

- As during the internals failure the thermal shield was allowed to bump on its supporting appendices welded on the stainless steel platting of the reactor vessel, a special attention had to be paid to the examination of these supports. Due to their position and shape the only suitable method is an underwater—visual inspection. Such a limitation is of a minor importance as the thermal shield has been definitely removed during the repairs, leaving its supports submitted to negligible low-level stresses.

The old design and material specifications lead to other difficulties:

- the inaccessibility of certain parts of the circuit for external inspection. It was mainly the reactor vessel and the part of the primary piping close by this vessel and embedded in the concrete shielding. Such a difficulty was overcome by the use of focused ultrasonics.
- the old type of thermal insulation not designed for easy removal: it costed a lot of man-rem to remove and replace it by a more convenient removable one.

- the reactor vessel material behaviour under irradiation is difficult to assess as during the repair of the internals it was not possible to reuse the irradiated samples necessary to evaluate the NDTT drift. Therefore the samples presently irradiated in the reactor are not strictly representative of the vessel metal (in particular, no sample representative of welded part is available). Although this material has better irradiation characteristics than its american equivalent, the operator takes into consideration the ASME reference curve. Such an attitude leads to a 120°C temperature to be maintained during the pressure test after ten years operation to guarantee the NDTT margin. A so high temperature makes painful the external visual inspection during the pressure test.

- the radiation field arising from corrosion products ranging from 100 to 300 mrem.h⁻¹ at the surface of the primary piping was personnel consuming as a great deal of work has been done along this piping: thermal insulation change costed 60 man-rem and surface cleaning about 22 man-rem. These values are high compared to the doses recorded for the complete inspection itself in 1976: about 20 man-rem.

Taking into account the experience gained during the maintenance outages and the work done to comply with the recommendations made by the safety commission for the increase of the thermal power of the reactor from the initial 905 to the actual 1040 MWth, the operator has performed a programme to improve and facilitate the inspections:

- development of automatic or remotely controlled apparatus as for an example eddy-current equipment for steam generator tubes visit or focused detectors ultrasonics.

- to speed inspection (mainly focused ultrasonics) development of fast data acquisition and processing in view to evaluate the results on the spot and to allow for an immediats repetition of the measurements on specific points, thus reducing the time length of the visit.

As a conclusion, it may be stated that this first in-service inspection has permitted to:

- verify that the administrative organization was adequate for the application of the new regulation;

- check the validity of the methods (in particular focused detectors ultrasonics) on such type of nuclear plant;

- to improve the design of future large PWR power plants to facilitate and to improve the effectiveness of periodic in-service inspection, together with decreasing its cost and duration.

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REGULATORY INSPECTION EXPERIENCE ON THE CONTAINMENT AND FILTERING SYSTEMS INSTALLED IN THE ITALIAN PLANTS AND THE PROCEDURES ADOPTED TO EVALUATE THEIR EFFICIENCY

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This paper consists of two parts. The first part concerns the methodologies used in the performance of the global leak test for the containers of the Trino Vercellese, Garigliano and Caorso nuclear power plants, the inconveniences found and the solutions adopted for improving the test results. In the second part, the testing techniques are described that are used for measuring the integrity of filters and their correct installation in the Trino Vercellese plant.

Ce mémoire est articulé en deux parties. La première traite des méthodes de réalisation des essais d'étanchéité globale pour les cuves des centrales électronucléaires de Trino Vercellese, Garigliano et Caorso. On illustre également, les inconvénients rencontrés ainsi que les solutions adoptées pour améliorer les résultats des essais. La seconde partie décrit les techniques qui permettent de mesurer l'intégrité et la bonne installation des filtres dans la centrale de Trino Vercellese.
INTRODUCTION

This paper consists of two parts.

The first part concerns the methodologies used in the performance of the global leak tests for the containers of the moderately water nuclear power plants of Trino Vercellese, Garigliano and Caorso, the inconveniences found and the solutions adopted for improving the results of the tests.

The modification of the emergency ventilation system of the annulus in the Trino Vercellese plant, to allow the increase from 0.1% to 0.3% of the permissible leakage rate, is here described in detail.

In the second part, the testing techniques are thoroughly described that are used for measuring the integrity of filters and their correct installation, and that are applied at the Trino Vercellese nuclear power plant before and after the above mentioned modification.
1. LEAK TEST MEASUREMENTS

1.1. Generalities

The technical prescriptions relating to the two moderated water nuclear power plants presently in operation in Italy, specify that the value of the plant container leakage rate should not exceed 0.1% of the free volume a day, at the maximum assumable pressure in case of accident. This value is by far lower that for which the container had been designed and is very close to the construction limits of same. This entailed considerable difficulties as far as the compliance with such prescriptions is concerned, and also led to the adoption of such successive modifications and expedients as described later in this paper. For the same reason it has proved impossible so far to formulate, for these containers, a correct approach in regard of seals degradations in between two tests.

The verification of this value involves a number of measurements and operations whose performance must be repeated every five years at least.

The container of the Garigliano nuclear power plant consists of a steel sphere entirely exposed to the external atmosphere, built on supporting metal columns and lying on a concrete bed.

The container in the Trino Vercellese plant is instead of a cylindrical shape with a half-spherical top and surrounded by a concrete structures serving as a biological shield allowing a certain degree of thermostatization of the container.

The leak of both containers was measured, at the project pressure, on completion of their construction, when they were still empty.

Later on, owing to the presence of apparatuses that might have been damaged by a high overpressure, it was thought advisable to perform periodical tests at a reduced pressure. The problem then became manifest of determining the correct extrapolation coefficient of the leakage rate at accident pressure. Several formulae with different hypotheses were adopted, but none of them proved satisfactory; consequently for the new plant presently in the start-up phase, the performance has been prescribed of two preliminary tests, one at accident pressure and the other at a reduced pressure, in order to be able to univocally determine, once for all, this extrapolation coefficient.

The methods used for the leak tests are the now classic ones of the reference chambers and of the absolute method.
As it is well-known, the absolute method is based on the criterion of measuring the temperature, the pressure inside the container as a function of time; thus, bearing in mind the fundamental law of gases $PV = nRT$, one may easily ascertain the quantity of air present in the container.

The reference chambers method uses an air-tight containers system interconnected and distributed throughout the container.

Under given hypotheses, it may be recognized, with a reasonable approximation, that the pressure in the reference system undergoes the same vicissitudes as the container's mean temperatures. Therefore, the difference between the pressure of the container and that of the said system is directly related to the amount of air leaving the container.

The optimal conditions for both methods would be that the temperatures inside the container were only a function of time and not of space. It is in fact a rather difficult job to map the entire volume involved in the tests with a high number of sensors (thermoresistances or reference chambers) to which a correct weight must be given to calculate the relative mean.

As it happens, in fact, since both the containers under examination are exposed to atmospheric agents, and chiefly to the sun, (this consideration especially applies to the Garigliano plant), considerable oscillations occur in the inside temperature, that which brings about a sizable dispersion of experimental data. Since the atmospheric conditions are of major importance for unsuccessful issue of the tests, it would be advisable to make measurements in sunless days and in those periods of the year in which the daily thermal excursion is minimal. In the Trino Vercellese plant, which is equipped with a system for spraying the top of the container, remarkable improvements were observed in the results obtained, whenever the system was made to function during the hot hours of the day.

Where plants for mixing the container's atmosphere are in existence, they ought to be kept in operation, taking care to evaluate the energy yielded to the atmosphere, if any.

1.2. Data processing method.

A numerical computation method has been defined for data processing purposes, which allows to express the variation in the container's amount of air as a function of time.

Since it is reasonable to assume, in first approximation, that such values can be represented by a group of points randomly distributed around a straight line, the program determines the most probable straight line and subsequently performs number
of statistical tests to accept or not the experimental points, reprocessing, at every step, the interpolating straight line.

The points that are gradually eliminated are those that are affected by systematic errors with probability rate higher than 95%. Taking into consideration the ratio of discards to the mean quadratic error, the points to be eliminated result to be those for which such ratio is higher than the value which is a function of the numerosity of the considered whole, and which for a sufficiently high number of points, tends to two.

The above mentioned verification takes of course for granted that the points considered come from a normal population. In fact, were is not so, there would certainly be a degree of confidence higher than 95% for the points discarded, but not for the points accepted. In other words, even if the eliminated points are almost certainly effected by systematic errors, it is not at all certain that the other remaining points are free from errors.

1.3. Trino Vercellese

At Trino Vercellese, after the considerable difficulties encountered in 1971, for fitting into the prescription limits (0,1%), it was resolved to increase the prescription rate to 0,3%; and to ensure the required safety with such an increased rate, some modifications were made in the emergency plant for the filtration of the annular air space, and in the container's insulation system.

The modifications to the emergency ventilation and filtration plant have involved, in particular, the duplication of the entire system with two 100% lines, as well as the replacement of the pristine filters, having a 90% efficacy for iodine removal, by others whose efficiency was higher than 99%.

In part two of this paper, the testing methods used for measuring the integrity of the new and old filters and their correct installation will be extensively dealt with.

The modifications made to the insulation system afford a further guarantee, to the effect that any possible leaks from the primary container are conveyed to the emergency ventilation system. According to this approach, the objective was pursued of eliminating, as much as possible, the leaks likely to bypass the annular air space. This was done by duplicating and or motorizing the valves inserted in the lines crossing the annulus, and by inserting connections to test same. Special attention was in fact devoted to the provisions of suitable means for the periodical testing of valves.
The above mentioned modifications involve some variations in the radionuclides releases outside the plant, in case of a reference accident.

With a 3% leakage rate and with a filter efficiency of 99%, the iodine doses to which the population is exposed are reduced by a factor three, while the doses to which the body is exposed as a result of cloud radiation, essentially due to noble gases, although showing an increase, are, at any rate, such below the commonly adopted reference values.

As regards the leak test and the subsequent data processings, the plant under consideration never presented excessive difficulties. The values obtained showed a rather reduced scattering and were comparable, irrespective of whether the absolute method or the chambers method was used. The use of the system for the spraying of the container's top during the sunny hours of the tests, has in fact allowed an excellent thermostatization of the inner atmosphere.

1.4. Garigliano

The seal test of the container of the Garigliano Plant was always a source of problems for the reasons referred to earlier in this paper. The results obtained usually led to an error of the same order of magnitude as the measured value. In addition to that, some problems were experienced in fitting into the prescriptions, and these problems were identified in the faulty seal of the sphere ventilation valves. It was thus decided to ensure that, in case of accident, upon a container insulation signal, the ventilation pipes were to be flooded through a diversion of the antifire lines, thus realizing an hydraulic barrier capable of guaranteeing the sealing of the lines. The test is thus performed by disconnecting the ventilation pipes and by plugging by means of a blank flange. While in the case of the Trino Vercellese container both methods were always adopted - the absolute one and the reference chambers - with satisfactorily comparable results, in the case of the Garigliano plant all tests have been effected so far using only the reference chambers.

Since the sphere is exposed to the sun, and there being no thermometers inside the chambers, it proves impossible to know the thermal gradients existing between the atmosphere of the container and that of the chambers, with an ensuing sizable alteration of the result obtained. After a very large number of tests which afforded scarcely reliable results, CNEN prescribed to ENEL an adjustment of the entire measurement system, basically consisting in the: 
1) - setting-up of a system of external spraying of the sphere capable of ensuring a satisfactory thermostatization of the container during the test performance;

2) - setting-up a suitable number of temperature sensors within the sphere, for temperature measurements by the absolute method. The arrangement and number of such sensors will be determined through a measurement campaign to be made on the occasion of the next shut-down of the plant;

3) - replacement of a pressure meter showing an insufficient accuracy;

4) - verification of the validity of the measurement method, superposing to the actual leaks a measured leak, and comparison of the results thus obtained with and without the controlled leakages.

1.5. Caorso

As regards the concrete and steel container of the ENEL IV Plant of Caorso, presently in the start-up phase, our experience is today confined to two consecutive tests at accident pressure and at a reduced pressure, plus a verifications with controlled leakages.

The container under consideration is inside a building called secondary container, and therefore is not affected by atmospheric agents. Therefore, the test lasted 24 hours only as against the 72 hours of the other plants, and the results were satisfactory and reliable, in view of the absolutely negligible dispersion of the points measured in respect of the compensation straight line.

Several pressurization and depressurization steps having been made, the phenomenon was clearly found that is called of "INGASING AND DEGASING". Therefore, during the pressurization phase, a negative pressure gradient occurred, which then disappeared, while, in the depressurization phase, a positive gradient likewise occurred, that rapidly disappeared. This leads to the conclusion that the measurements for a correct test must be performed some hours after the end of the pressurization phase, this also with a view to obtain a homogenization of the temperature, when a suitable mixing system is available.
2. TRINO: MEASUREMENT OF THE INTEGRITY OF FILTERS AND OF THEIR CORRECT INSTALLATION.

2.1. Freon 12 method

To check for the integrity and correct installation of the activated carbon filters, it was used on the pre-existing plant (prior to the modification) a procedure using Freon 12 as a tracer.

To ensure that the test was significant, without distorting the results, special conditions were to be complied with, and particularly:

- Air speed in the filter not to exceed 0.1 m/sec.
- Air maximum temperature: 35°C.
- Maximum water content in carbon: 5% in weight.
- Duration of test not exceed 5'.

A G.E. Leak Detector was used for the measurements.

2.2. Freon 112 method

Following the filtering plant modifications in 1976 it was decided to verify the correct installation of the new filters using a procedure and some equipment put through by FARR Company.

Late this year, the test will be repeated using procedures and equipment slightly different.

Both the procedures basically consist in injecting a tracer (tetrachlorofluoroethane – Freon 112) into the air current upstream of the filters. The concentrations of the tracing compound are evaluated upstream and downstream of the filtering pack under examination and the leak in percentage is calculated as a ratio of the tracer concentration upstream of the filtering pack.

2.2.1 FARR testing method

This method allows to evaluate penetrations lower than 0.03%.

The tracer detection method includes: a chromatograph, a recorder unit, a pump for sucking samples, some flow meters, and auxiliary equipment.

A sampling valve allows to alternately pick up samples upstream and downstream of the filter, diluted and non diluted, in a pre-fixed dilution ratio.

A specially designed Freon 112 generator injects into the system the amount of tracer required.
2.2.2. New method

This method, although using the same tracer gas, and a chromatograph gas as a detector, substantially differs from the previous method in the sampling method and in the measurement modalities.

Each sampling system consists in a battery of seven 50 cm³ vials, equipped with a high-vacuum tap and with a lateral pierceable membrane. They are connected in parallel, through a first manifold, to the pick up point (placed upstream and downstream of the activated carbon filter under examination) and, through a second manifold, to a vacuum pump suction. The control of the depression and of the flow of the sampled effluent, is made using a vacuometer and a rotameter, inserted in the circuit.

2.3. Conclusions

It may be stated, in the broad lines, that all the methods used at the "E. Fermi" plant allow to perform integrity tests on carbon filters, but the specific features of each of them lead to the following conclusions.

The Freon 12 method involve onerous limitations in matter of speed, air temperature, and quantity of humidity adsorbed by the carbon.

In reality, in the filtering installations, speeds very easily occur of the order of 70 ft/minute, and relative humidities of 25%.

At the "E. Fermi" plant, this inconvenience was partially remedied by reducing the speed and air humidity with the aid of an ancillary aspirator and of a silice gel bed prepared "ad hoc" for the test.

Leakages lower than 0.1% of the total flow are difficult to detect because, under these conditions, more than 0.1% of the adsorbed Freon, desorbe from the carbon in less than one minute.

At any rate, prior to the modification made to the ventilation plant, the carbon filters, answering to the prescriptions, must have a 90% efficiency; therefore, the method then used was considered fit for the purpose.

The new method we intend to adopt on carbon filters with a 99% efficiency, demands the use of an injection technique capable of ensuring the repeatability of the tests.
The sampling technique envisaging the use of syringes for gas-chromatography, was previously tested in Italy at the Nuclear Plants Institute of the University of Pisa, in collaboration with the Safety Division of CNEN. The syringes used were made of glass with a fixed stainless steel needle and with a teflon piston to ensure seal. The difficulties encountered in trying to acquire an injection technique capable of ensuring the repeatability of tests, were considerable. It was noted that the parameters having an influence on the response of the instrument are numerous and largely dependent upon the operator's skill.

In injecting the tracer mixture, care should be taken that the same length of the needle (practically the whole length) is inserted at all times; that at the time of the injection, such a pressure is exercised on the piston, as to prevent the leak of a certain amount of the mixture to be injected, and the entrance of nitrogen into the syringe with ensuing pressure variations in the gas-chromatograph column; that, during the injection, an even pressure is always exercised on the piston, to avoid even the slightest pressure variation in the column; that the same amount of mixture is injected in the same period of time; that the injection is made very rapidly and that the syringe is withdrawn with the same rapidity.

The delicacy and sensitivity of the gas-chromatograph with an electronic-capture detector, are such that even the slightest variation in the parameters previously identified, would lead to results that are anything but real.

The conclusion was thus reached that a better or worse functioning of the gas-chromatograph is entirely dependent upon the higher or lower skill on the part of the operator. A skill that, as proved by previous experiences and investigations, can be acquired only through a long training under the guidance of specialized personnel.

The testing method prepared by FARR, thanks to the use of the sampling valve and a dilution valve, does not show the drawbacks experienced in the previous test, and is to be regarded, therefore, as the most suitable and reliable method.

It should be pointed out that through the said testing methods, only the condition of the filtering installation is checked, no information being obtained as to the intrinsic efficiency of the absorbing material.

Since what actually interests us is the behaviour of the entire filtering system, "capsules" were prepared containing carbon belonging to the same lot as the main filter and exposed to the same
working conditions on which basis the efficiency of the absorbing material in the nominal operating conditions and in the testing conditions, is to be determined in laboratory (during the life of the filter). This last datum allows, in fact, to complete the analysis of the efficiency of the entire installation.

3. GENERAL CONCLUSIONS

As regards the seal test of containers, it may be stated that once the modifications required for the Garigliano plant will become operative, this type of measurement may be regarded as sufficiently standardized, and should not require further adjustments.

Conversely, for what concerns the integrity measurements of filters, we are awaiting the results of the testing techniques now in development, in order to be able to define a clearly acceptable method with a repeatability and comparability of the results obtained.
To the Session Chairmen

The Chairman of the final panel wishes that each session Chairman would present at the beginning of the panel a brief summary of his session, pointing out the principal conclusions reached, the problem areas identified, the points to be elaborated during the panel, some proposals for future CSNI work to be submitted to the panel for consideration.

These statements should represent the conclusive remarks of the short reports on each session, to be prepared in written form by the Chairmán and Scientific Secretaries, as contributions to the final report on the Specialist Meeting to be presented to CSNI.
MANAGEMENT BY REGULATORY INSPECTION AUTHORITIES OF EXPERIENCE GAINED FROM SAFETY RELATED OCCURRENCES IN NUCLEAR POWER PLANTS

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A short description is given of the system used by the Swedish Nuclear Power Inspectorate to collect information of events occurring in nuclear power plants. The standard forms used by the utilities when reporting the events are described and a motivation given to their lay-out. The evaluation routine is defined and statistics given of events which occurred during the period July 1 1974 to December 31 1976.
In Sweden, the Swedish Nuclear Power Inspectorate (SNPI) is the inspection authority stipulated in the Atomic Energy Act, and the Government permit for the construction of a nuclear power station includes the condition that the station owner "shall follow the directives which are issued by the Nuclear Power Inspectorate for the design, construction and operation of the nuclear power plant and which are essential for safety".

One of the directives issued by SNPI is that it must be kept continuously informed about the operation of the nuclear power station and particularly about all deviations from normal conditions. The collection and systematization of information on the operation of nuclear power stations have the following functions, amongst others, for SNPI.

- to provide guidance for control and inspection work and to provide source material for changes in the plant or other plants in operation

- to feed back experience from stations in operation to stations which are being constructed or planned.

According to the Technical Specification for the plants the licensees have a reporting duty to SNPI. These reports are partly of routine character, e.g. daily, monthly, and annual reports or special reports after every refuelling, partly non-routine reports.

The non-routine reports comprise not only abnormal occurrences and reportable events which are classified similar to the classification in NRC Reg. Guide 1.16, but also reactor trips. The abnormal occurrences should be reported to SNPI on a special form within 24 hours and, if it is not possible to fill up the form in full in that short time, in final version within 10 days.

The reportable events should be reported together with the daily report and be given in its final version, if applicable, within 30 days. The form is the same as that for abnormal occurrences and is shown in Figure 1.
On the form should be recorded:
- name of power station and unit number
- preliminary or final report
- abnormal occurrence or reportable event with reference to actual chapter in Tech.spec.
- system and component
- date of discovery
- reporting date and name of reporter
- operation mode at discovery
- way of discovery
- symptom
- consequence on operation
- consequence of equipment
- component
- measures taken or planned
- cause
- latent cause

On the back-side of the form a description in words should be given on
- what actually happened and the consequences
- probable cause of error
- measures taken or planned

This type of form with a "fill-up"-system has been introduced by SNPI to give basis for a statistical treatment of the events and of course to be able to use computer for the compilations. We believe that this system also makes it easier for the operating staff to give SNPI the needed information. The type of information which is needed for a review of an incident has been thoroughly analyzed and the different headings on the form is a result of this analysis. The ambition has been to restrict the number of headings to cover just one page, as we believe that the operating staff does not want too many kinds of forms to handle. They must feel for living with the system. Thus a weighing has been made between the extent of information to be received and the possibility to get good information through the staff,

The reactor trips should be reported to SNPI on a special form together with the daily report. This form is shown in Figure 2 and the following items should be recorded on it:
- name of power station and unit number
- date of trip and name of reporter
- released trip condition
- operation mode before trip
- operation date before trip
- description of what happened
- cause of trip
- measures taken.

The safety related events are analyzed and categorized with respect to their potential risk. The following six categories were used from the beginning:

1. A defect in a component or a system which is not required either for operation of the station or for the function of any safety system, e.g. in an industrial water system.

2. A defect in a component or a system which is required for the operation of the station but not for the function of any safety system, e.g. in the turbine generator.

3. A defect in a component or a system which does not, due to an available spare part, require an immediate stoppage in accordance with the safety directives, e.g. in a starting-air container for a diesel engine.

4. A defect in a component or components or in a system which gives rise to a shutdown of operation in accordance with the safety directives e.g. a simultaneous defect in two charging pumps.

5. A crack or failure in a small-bore pipe (diameter not larger than 50 mm) in the pressure-bearing parts of the reactor cooling system inside the reactor containment; in the case of a pressurized water reactor, also in the pressure-bearing parts of the secondary side inside the containment.

6. Other disturbances of major scope.

Only categories 3, 4, 5, and 6 are classified as incidents of safety significance and only these are reported to SNPI and included in the reports from SNPI.

This material of events gives a very valuable basis for an evaluation of critical parameters and a lot of distributions are possible. In the reports the events have also been distributed due to
- system groups where the event occurs
- components initiating the event
- causes to the event

SNPI publishes information on operational experience in its Quarterly Reports and in its Reports on incidents of safety significance and on reactor trips. The quarterly reports contain a selection of abnormal events together with a brief description of the operation at each nuclear power unit. The reports on incidents of safety significance and reactor trips, which are published every 6 months, are of a more technical nature than the quarterly
reports and contain a complete, though brief, review of all such incidents and reactor trips during the period covered. In Figure 3 and 4 are shown examples how incidents and reactor trips are illustrated in the semi-annular report.

This reporting system has been working since July 1 1974. Some results, which have been achieved from the use of the system will be described.

In Table I is shown all safety related occurrences during the period July 1 1974 to December 31 1976 in Swedish nuclear power plants. Of the 158 incidents which occurred, the overwhelming majority (134) belong to category 3, i.e. they did not require any shutdown of the reactor. Only 23 incidents belonging to category 4 and only one incident belonging to category 5 occurred and no incidents at all belonging to category 6 occurred. No incidents have had consequences of significance for the safety of the surroundings. The single incident belonging to category 5 happened in the PWR Ringhals 2. Due to small leakage a crack was detected in a T-shaped tube in the coolant injection system.

In Table II the same events as used in Table I are distributed due to components initiating the events. You can see that most of the incidents of safety significance are due to defects in valves and pumps etc i.e. in conventional components.

In Table III are shown the events during the last half-year 1976 distributed due to system groups where the event occurs and in Table IV due to causes to the event. Other distributions are of course possible.

In Table V are shown all reactor trips during the period July 1 1974 to December 31 1976 divided into different origins of disturbances. As can be easily seen, the turbine generator system is the big villain. I contributes on an average about 50% of the disturbances which cause reactor trips. The control equipment comes next, its contribution being 25% of the trips.

Up to now all the work with this reporting system has been made manually. That has been very labourous and taken too many man-hours from skilled people. Therefore a short time ago a computer has been obtained which just now is programmed and will be used for the events which have happened during the first half year 1977. This will among other things, have the result that the semi-annular reports can be published with less delay than now. It will also be very easy to choose different distributions concerning causes to the events and eventually it will be possible to find new trends in the material.
When more experience has been obtained it may be necessary to change the reporting forms. You may have noticed that e.g. human errors are not mentioned in the forms. This kind of error could be difficult to get reported from the operating staff itself and maybe we will have to draw conclusions about human errors ourselves at the safety review of the events. Up to now our experience has been good with the actual forms and no change is planned during the near future.

The detailing of the regulations of nuclear power plants which up to now has taken place has resulted in increasingly better guidance for designers and the safety inspectors and has been intended to improve the safety of nuclear power plants. It now seems likely, however, that a state has been reached where the rapid growth of new requirements which has taken place so far will begin to diminish. Future changes will probably be more the result of research results or specific experience.

We therefore regard this system of collecting experience as very valuable as it in the long run gives indications about the above mentioned changes. In the short run the reporting system gives sufficient information about the individual events to make it possible for the inspectorate to take actions if necessary.

This has of course also been done, partly for the actual plants where the event occurred, partly for other plants if applicable. The practical value is thus striking.

The event reports have been paid attention to as well in Sweden as abroad. Among foreign bodys US, German, French, British, and Finnish authorities could be mentioned who are put on our mailinglist. Anybody who wants has the opportunity to join them as the information is unrestricted.
**Distribution:**
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**PREMILINÄR**

**Slutlig rapport nr:**
B-13/77

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<td>Ställverksutrustning</td>
</tr>
</tbody>
</table>

**VIDTAGEN ELLER PLANERAD ÅTGÄRD **

**ORSAK * **

**BAKOMLIGGANDE ORSAK **

| Utbytte av del(ar) inom resp. objekt | Korrosion, erosion | Konstruktionsfel |
| Utbytte av rapporterat objekt     | Onormal försilting | Materialfel |
| X Reparation av del(ar)           | Obalans, utmatning | X Tillverkningsfel |
| Justering, kalibrering            | Vattenslag, tryckstot | Montagefel |
| Rengöring, smörjning              | Deformation, forskjutning | Brist i underhåll |
| Ingen åtgärd på komponent/apparat | Spricka | Brist i driftinstruktion |
| Annan åtgärd:                     | Brott | Manöverfel |
|                                  | Brand, explosion | Felaktig vattenkemi |
|                                  | Jordat | Annan orsav: |
|                                  | Kortslutning | |
|                                  | Spänningsluset | |
|                                  | Annan orsav: | |

De med * märkta kolumnerna behöver endast ifyllas i slutlig/definitiv rapport.
HÄNDELSEFÖRLORPP OCH KÖNSEKVENSER:

Vid periodisk provning av dieselgenerator 660 DG 111 erhölls märkeffekt utan anmärkning. Efter en kort stund började effekten driva nedåt till 0,9 MW. Från denna effektnivå gick det sedan ej att öka effekten.

DG 112 fungerade vid samma provningstillfälle utan anmärkning.

SANNOLIK FELORSAK:

Kärvning (p g a rost) i regulatorns dämpcyliner.

VIDTAGNA ELLER PLANERADE ÅTGÄRDER:

Rengöring och smörjning av dämpningscyliner och röriga delar. DG 111 var åter driftklar och provkörd 1977-08-03 kl. 21.00

Nya delar inmonteras så snart dessa anlänt från Tyskland, dock senast under RA1-77.
Snabbstoppet inträffade: 1977-08-12
Snabbstoppets rapport utfärdad av: Rolf Gustafsson

Utlöst snabbstoppsvillkor:
SS 15 (TS-O utlöst)

Driftläge före snabbstoppet:
Dumpning, upprullning av turbin.

Driftdata före snabbstoppet:
Reaktoreffekt: 15 % av full effekt
Generatoreffekt: _____ MW
HC-pump-flöde: 3 000 kg/sek
Styrstavsmönster: 8612

Beskrivning av händelsen:
Vid upprullning av turbin till 3 000 rpm erhålls höga lagervibrationer (TS 28) vid 2 950 rpm.

Orsak till snabbstoppet:
Höga lagervibrationer ger vakuumsläckning och därmed dumpförbud till turbinkondensorn.

Vidtagna åtgärder:
Ombalansering av turbin LT-rotor vänster. En skovel var av ca 115 mm från toppen.

Övrigt:
RIN2 761221 830MWe  SYS=322  CAT=3  TYP=106 / 201 / 312 / 409 / 504 / 606 / 707 / 813 / 909
WHEN SHIFTING CHARGING PUMP IN OPERATION, PRESSURE AND FLOW DECREASED. PUMP NO 1 WAS STOPPED AND NO 3 STARTED.
PUMP HAD BEEN FILLED WITH GAS IN SPITE OF CHANGED START FREQUENCY.
THE VOLUME CONTROL TANK WILL BE DEGASSED EVERY 24 HOURS AND THE PUMP EVERY 8 HOURS WHEN NOT IN OPERATION.

RIN2 761205 820MWe  SYS=657  CAT=3  TYP=106 / 201 / 302 / 401 / 502 / 611 / 707 / 815 / 901
INVERTER TRIP CAUSED REACTOR TRIP. 9 SEC LATER SAFETY INJECTION SIGNAL BUT MOST A-BUS SAFETY COMP DID NOT START.
RELAY FAULT CAUSED OVERLOAD AND SHORT CIRCUIT. INVERTER TRIP CUT OUT VOLTAGE TO TRIP RELAY IN SAFETY TRAIN A.
CORRESPONDING RELAYS ON THE OTHER INVERTERS HAVE BEEN REMOVED. INVESTIGATION IS GOING ON. SYSTEM IMPROVEMENTS.

RIN2 761124 800MWe  SYS=651  CAT=3  TYP=106 / 203 / 304 / 409 / 503 / 607 / 705 / 813 / 905
DIESEL GENERATOR 230 DID NOT RUN UP NORMALLY BUT TRIPPED ON "LONG STARTING TIME". RENEWED START FAILED ALSO.
DIRT WAS FOUND IN A VALVE WHICH DISTRIBUTES AIR FOR STARTING PURPOSE.
THE VALVE WAS CLEANED. THE FILTERS IN THE AIR PIPE WILL BE CLEANED MORE FREQUENTLY.

RIN2 761113 500MWe  SYS=334  CAT=3  TYP=106 / 201 / 302 / 409 / 502 / 605 / 701 / 805 / 909
BORIC ACID PUMP 2 TRIPPED REPEATEDLY. DAMAGED BEARINGS WERE EXCHANGED BUT NEW TEST GAVE STILL BAD PRESSURE.
A DIAPHRAGM IN A VALVE HAD OBSTRUCT THE DISCHARGE CAUSING THE PUMP TO WORK WITHOUT FLOW.
THE VALVE WAS FIXED.

RIN2 761112 0 MWe  SYS=416  CAT=3  TYP=103 / 203 / 304 / 409 / 503 / 606 / 704 / 818 / 904
ON TESTING TURBINE DRIVEN PUMP A LIMIT POSITION FAULT WAS FOUND ON A BY-PASS TO THE GOVERNOR VALVE.
LIMIT POSITION PROBABLY DISPLACED DURING MAINTENANCE. ANOTHER FAULT WAS A BIG LEAKAGE THROUGH GOVERNOR VALVE.
A DAMAGED DIAPHRAGM IN THE BY-PASS VALVE WAS CHANGED. THE PACKING GLAND ON GOV VALVE WAS SLACKED A BIT.

RIN2 761019 803MWe  SYS=334  CAT=3  TYP=106 / 201 / 301 / 407 / 504 / 606 / 707 / 813 / 909
WHEN CHANGING FROM CHARGING PUMP 3 TO 1 THE DIFF PRESSURE OVER SEALS ON REACTOR COOLANT PUMPS DISAPPEARED.
AFTER EVACUATING THE PUMP FROM DEGASSED AIR IN PUMP HOUSING IT WORKED ALL RIGHT.
EACH CHARGING PUMP WORKS 1 WEEK AND STANDS 2. STANDING PUMP WILL NOW BE EXERCISED 4 HOURS.

RIN2 760802 480MWe  SYS=651  CAT=3  TYP=106 / 203 / 309 / 409 / 503 / 607 / 703 / 806 / 904
ON TESTING DIESEL GENERATORS LUBRICATING OIL LEAK IN PIPE CONNECTION TO TURBO COMPR ON DG 220 WAS FOUND.
A BADLY MADE WELDING.
THE DIESEL GEN WAS IMMEDIATELY STOPPED AND THE PIPE WAS REPAIR WELDED.

RIN2 760802 430MWe  SYS=416  CAT=3  TYP=106 / 201 / 312 / 409 / 503 / 604 / 701 / 801 / 909
GASKET TO FILTER IN A STEAM TRAP HAD BLOWN OUT. PUMP ROOM FILLED WITH STEAM. WATER ON THE FLOOR.
THE GASKET BLEW DUE TO CORROSION ON THE FLANGE WHICH HAD GRADUALLY INCREASED. GASKET OF WRONG MATERIAL.
THE FACE OF SEALING JOINT WAS TURNED DOWN AND THE KLINGERIT GASKET WAS CHANGED TO METAFLIX.
<table>
<thead>
<tr>
<th>UNIT</th>
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</table>

**OSK1**
- Connection fault in overspeed monitor tripped turbine. Vibrations led to lost vacuum.
- A leakage in a flanged coupling filled a monitoring well on floor with water.
- Not functioning reducing station to preheater 4 caused low pressure in preheater.
- Scaffold fell over sys 435 causing unjustified turbine trip and dump blocking.

**OSK2**
- During shut down of the unit the automatic high-speed switching on 6kV busss failed.
- On periodic test of level monitors in reactor, channel A tripped before C was reset.
- Trip due to vibrations. Pressure transient caused high neutron flux.

**RIN1**
- Stop of one condensate pump caused flow variations: low water level in reactor.
- A crack in weld on safety valve (Dia 1") caused leakage. Monitoring well water filled.
- Defect tachometer. Increase of main circ pump flow in spite of constant SET point.
- Increase of main circ pump flow in spite of constant SET point, investigation.
- Feed water pump 2 could not supply reactor with enough water. Sinking reactor level.
- Wrong trip condition for dump blocking caused by temp- and flow monitors in dump pipe.
- The QF protection tripped the main transformer 11. Turbine trip + dump blocking.
- Janitor poured water in monitoring well. Unsufficient information.

**RIN2**
- Inverter trip due to exceeded current limit and high steam flow caused reactor trip.
- Generator trip when turb operator switched from field current to voltage regulation.
- Low level in steam gen 3 + feed water/steam mismatch due to a malfunctioning valve.
- Low flow in sys 719 tripped condensate pumps. Low level in SG 3 + steam/FW mismatch.
- Fault on actuator to valve which opened. Extra low level in steam gen 1 and 2.
- Trip of condensate and FW pump caused low level in steam gen 3 + steam/FW mismatch.
- Damaged baskets in screen house due to jelly-fish. Man turb trip led to reactor trip.
- Flow dip in sys 719 tripped condensate pumps. Low level in SG + steam/FW mismatch.
- Extra high level in steam generator 3.
- Extra high level in steam generator 2.
- Low level in steam generator 3 + steam/Feed water mismatch.
- Low press in sys 719: turbine trip, FW flow swingings and extra high level in SG 3.

**BAR1**
- Reactor press below 60 bar when vacuum was drawn + power peak over 5%: dump blocking.
- A faulty temp monitor in condenser caused dump blocking due to high temperature.
- In conn with cleaning a water hose coupling came loose. Water in monitoring well.
- On an overspeed test of the turb, a manual action caused pressure pulse in reactor.
Table I. Safety related occurrences during the period 1974-07-01 to 1976-12-31 in Swedish nuclear power plants.

<table>
<thead>
<tr>
<th>Plant</th>
<th>Safety category</th>
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<tbody>
<tr>
<td></td>
<td>3</td>
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<tr>
<td>Oskarshamn 1</td>
<td>15</td>
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<tr>
<td>Oskarshamn 2</td>
<td>22</td>
</tr>
<tr>
<td>Ringhals 1</td>
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<tr>
<td>Ringhals 2</td>
<td>29</td>
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<tr>
<td>Barsebäck 1</td>
<td>42</td>
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<tr>
<td><strong>Subtotal</strong></td>
<td><strong>134</strong></td>
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</table>

Total: 158

Category 3: Fault not requiring stop of operation
Category 4: Fault requiring stop of operation
Category 5: Crack or break in pipe inside containment less than 50 mm in diameter
Category 6: Fault with greater significance
<table>
<thead>
<tr>
<th>Type - Component</th>
<th>OSK 1</th>
<th>OSK 2</th>
<th>RIN 1</th>
<th>RIN 2</th>
<th>BAR 1</th>
<th>Sum</th>
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</thead>
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<td>601 - Pressure vessel</td>
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<td>602 - Heat exchanger</td>
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<td>603 - Pipe</td>
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<td>604 - Flanged coupling</td>
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<td>605 - Valve including positioner</td>
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<td>606 - Pump, fan</td>
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<td>608 - Regulating equipment</td>
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<td>609 - Switchgear equipment</td>
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<td>612 - Control equipment</td>
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Reported events since 74-07-01: 158
Table III
Safety related occurrences 76-07-01--76-12-31
by system-groups

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<th></th>
<th>OSK 1</th>
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<th>BAR 1</th>
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Table IV
Safety related occurrences 76-07-01--76-12-31
Causes

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<td>803 - Unbalance, fatigue</td>
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<td>-</td>
<td>-</td>
<td>-</td>
<td>2</td>
</tr>
<tr>
<td>812 - Other electrical fault</td>
<td>-</td>
<td>-</td>
<td>1</td>
<td>-</td>
<td>-</td>
<td>1</td>
</tr>
<tr>
<td>813 - Dirtiness</td>
<td>-</td>
<td>-</td>
<td>2</td>
<td>3</td>
<td>1</td>
<td>6</td>
</tr>
<tr>
<td>814 - Strange object</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>815 - Overheating, overloading</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>1</td>
<td>-</td>
<td>1</td>
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<td>816 - Deviations from operating</td>
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<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>817 - Seizure</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>818 - Untightness</td>
<td>-</td>
<td>1</td>
<td>-</td>
<td>1</td>
<td>1</td>
<td>3</td>
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<td>819 - Wrong adjustment</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
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<tr>
<td>820 - Handling fault</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>821 - Other cause</td>
<td>-</td>
<td>-</td>
<td>3</td>
<td>-</td>
<td>1</td>
<td>4</td>
</tr>
</tbody>
</table>

2 7 7 8 13
Table V. Reactor trips during the period 1974-07-01 to 1976-12-31 in Swedish nuclear power plants.

<table>
<thead>
<tr>
<th>Plant</th>
<th>Reactor and its auxiliary systems</th>
<th>Turbo-generator plant</th>
<th>Control equipment</th>
<th>Electrical power supply</th>
<th>Others</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oskarshamn 1</td>
<td>1</td>
<td>13</td>
<td>7</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Oskarshamn 2</td>
<td>8</td>
<td>8</td>
<td>10</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>Ringhals 1</td>
<td>10</td>
<td>36</td>
<td>27</td>
<td>11</td>
<td>3</td>
</tr>
<tr>
<td>Ringhals 2</td>
<td>0</td>
<td>72</td>
<td>23</td>
<td>10</td>
<td>6</td>
</tr>
<tr>
<td>Barsebäck 1</td>
<td>10</td>
<td>13</td>
<td>7</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td><strong>Subtotal</strong></td>
<td><strong>29</strong></td>
<td><strong>142</strong></td>
<td><strong>74</strong></td>
<td><strong>24</strong></td>
<td><strong>19</strong></td>
</tr>
</tbody>
</table>

Total: 288
SESSION IV

SPECIFIC PROBLEMS AND PRACTICAL EXPERIENCE OF REGULATORY INSPECTION DURING OPERATION

PANEL DISCUSSION:

CHAIRMAN: CALORI

CALORI: Gentlemen, let me make a practical suggestion. As you can see, we have five papers in our session and the first three of them are dealing with rather general problems related to operation experience in Spain, U.K. and U.S. The last three, on the contrary, are dealing with more specific problems related to more specific areas, like pressure tests on the pressure boundary of nuclear power plants, containment, filtering systems in Italian plants and managing by special authorities and the experience gained from safety related occurrences in nuclear power plants in Sweden. Therefore, I propose to split the discussion in two parts. The first one could deal with the first three papers together. In order to start the discussion, I could perhaps put a question to our Spanish colleague. Mr. Bernal, in your paper you say that special consideration should be given by the operation inspectors to analyse the radiation dose of the personnel and to a periodical revision of important documents for the operational plants, such as safety reports or operation specifications. Now, my question is somehow related to a more general topic concerning the relationship between licensing and inspection. We already decided to discuss it later but, nevertheless, I would like to put it all the same. Don't you think that periodical changes of the safety reports or operational specifications are tasks of the licencee rather than of the inspectors?

G. BERNAL: I am going to answer your question gladly and I believe you are right to put it in that way. Really, I insisted on it earlier
on with a practical example. When the licencsee tries to change some of the operating standards or technical specifications, because he attempts to change some system, for instance the gas treatment system, we insist very much and we force him to discuss the changes within the committee that I mentioned before. Once the problem has been discussed by the power station committee, they send a request asking for the change to be approved and generally our working procedure is the following: generally, in that technical meeting takes part personnel of the station specialized in the matter; in the case of radiation protection, the head of radiation protection or his alternate; in a matter of maintenance, the head of maintenance and generally also the head of the power station. In addition, we also use to invite personnel of the licencsee's safety committee and this technical meeting takes place at the J.E.N., in our offices. From the side of the J.E.N., not only the inspection people are involved, but also people from the assessment group, who must be aware of the problem. There is a previous discussion which could solve the problem, if not, the documents are exposed and studied in coordination between the inspection and assessment groups, never by the inspection group alone.

GAUSDEN: I have a little bit to comment on that and I say that the procedures we adopt, essentially, rely upon a system for typical changes coming forward, being properly processed by a safety review body. The inspectors, of course, have the role to coordinate that activity and to make sure that the appropriate technical assessment is carried out within the inspectorate, calling upon specialist safety evaluation people in the process.

CALORI: I think that this afternoon there has been a question regarding the role and the duties and powers of the safety committee of nuclear plants. I think it is a very interesting point to discuss, because it seems to me that in various countries there are somewhat little differences between the duties and the powers of these safety committees. For
instance, in Italy the safety committee has the duty to give advice to the station superintendents for every change, modification, etc., to the normal operation, the station superintendent has the right to take actions, of course within the limits, within the frame of the operation specifications. Everything which goes outside these technical specifications has to be specifically approved by the central authority. This is more or less the role of the internal sitting committee in the plant. Could anybody comment on this point, on the role and the powers and duties of the safety committee in nuclear plants?.

G. BERNAL: We understand that the safety committees of the power station and the licensee must fulfill a double condition; one of these, perhaps the most important one, is that no problem would be decided by a single person of the power station but it has to be discussed by a compact, responsible team which can give the guarantee that the decision taken is the correct one. A second part is that the safety committee memos, those of the power station and the licensee committee must be kept together in the technical file of the power station. There should be a record in the power station, of all activities and changes carried out. All this is of a major importance in connection with the documents of the power station which must be up-to-date at any time. I believe this is a very important part of the safety committee.

GRONOW: I think one ought to recognize that in the systems of regulatory control, it is the principle that the licensee provides his own systems so that you do not really need a regulatory body for safety. So, the safety committee function in that context is to provide that safety regulatory aspect. Therefore, they must provide an internal system for checking the actions they take, the third time or the second time in this case, of examination by the regulatory body provides another check. Perhaps the safety committee may be overinfluenced by operational requirements.
One may see that in some circumstances, but the essential role is to provide an internal selfchecking system and the safety committees provide this sort of roles for the licencees similar to the inspection bodies which provide the service during the construction and commissioning.

COURVOISIER: I think Mr. Gronow is right, these committees do have quite a function on the site of the operator, they at least eliminate the possibility that one man, the station superintendent or whoever he may call, dictates what happens at the plant. We demand that any member of the safety committee can call for a meeting, this bridles the power of the station superintendent, but still it is, at least in Switzerland, a committee which consists of people of the plant only. We have not asked so far, because there was no good reason to do so and no possibility to ask for it, that outside persons be members of the committee. There is, I guess, a good point in not asking for that, as the committee may have to handle cases which are urgent. It would not be functioning if the outside member will not be present. So, I would like to stress again that the committees are important but they are committees of the operator. They do not relieve the task which we have as inspectors, only to a small degree.

CALORI: It is quite sure, it is the same in Italy. The safety committee is made of people of the nuclear plants, I don't know if it is the same in Switzerland, but the committee in Italy has an advisory function. The final responsibility lies on the station superintendent.

GAUSDEN: I would like to direct a question to Mr. Grier, although it arises in part from the presentation done by Mr. Nilsson. Mr. Grier in table VI of his paper was listing the percentage of the LER's for various causes, and one of these was 16 odd percent for personal error. If one
takes the total number of reports, this is something like 300 or more in that particular year. Mr. Nilsson said that in his reporting forms information on human error is not included, because he thinks this may well be a difficult information to obtain. The two, at the moment, do not seem to line up. I would like to ask Mr. Grier whether the information on human error is something which is readily obtainable or there are difficulties in getting this information.

GRIER: I think there are some difficulties of reporting procedures, at least in standing reports. The licensee completes the LER form which indicates the cause of that. This report is submitted to the regional office, copies also go to the headquarters office of NRC, and is our procedure to have responsible inspectors review the reports and to make their own evaluation whether or not the cause is properly indicated. Before the information goes forward and comes into the computer file, the causes have been reviewed and the agreement reached has to put what the cause should be. I think there is a tendency sometimes on the part of the licensees to attribute the cause to something other than their own personnel or their own mistake, if you will, placing it on the nuclear system supplier, architect engineer and so on, but we try to do those evaluations when the reports come in and we verify that the cause is indicated.

LEWIS: Mr. Grier, is there any truth in the report that the licensee operators of nuclear power plants in the United States are fined for operator error resulting in loss of plant availability?.

GRIER: Do you mean the individual operator?

LEWIS: No, I am thinking on the sanction placed on the operator by the licensee. In other words, he pays for his mistake, is it not so?
GRIER: I'm not aware of that, if it is so, it is an internal licensee matter. We have not imposed fines on this point directly on individual operators. Several penalties have been levied against the utilities.

LEWIS: No, but my point is, if I may repeat it, that the licensee is fining the operator for loss of his generation. I would have thought this was a bad form because it would then prevent operators admitting blame to the regulatory authorities if they are themselves on the penalty by the licensees themselves. Do you know if this type of penalty has been applied to operators?

GRIER: No, I don't, I'm not aware of that.

LEWIS: I only have a supplementary question to Mr. Nilsson. From the experience of reporting of defects, I was rather surprised to find the frequency of reporting and rather the scale of reporting. Is there any suggestion with the Swedish authorities now so that they make it more purposeful? In other words, is it not necessary a case of letting information on minor failures of plants but reporting safety related incidents? Do they intend to revise the requirement placed on the licensees?

NILSON: Just now, we do not revise, we are looking over this system. We are not going to revise it for the moment but the question is interesting and we will think it over.

COURVOISIER: Could I come to the question asked by Mr. Lewis? and ask in addition: Is there anything we can do to help the operator to operate in a psychological equilibrated situation, if he were under the threat of having to pay for errors he makes? It might be a very difficult situation for him and it might just lead to errors instead of avoiding them. Can we as regulators do anything to help that the operators can operate as freely using their qualifications, their possibilities in a free way without being under such constrains?
GRONOW: I do not intend to attempt to answer Mr. Courvoisier's question but I believe that the present climate within the nuclear operating staff is to provide the instruction: when in doubt shut down. They perhaps have more experience in other places but I suggest that it is not so. Our experience is that, in fact, operators do take the most cautious steps and they make operating errors by mistake in judgements. I want to return to the question really of information. We heard that in Sweden they require daily reports. We have a modest reactor program, but nevertheless, the mode of information which is coming forward both from the licensee, from inspectors reports and from various other inspections carried out throughout the year, demands an enormous amount of material which has to be processed, stored and treated. One of the observations we made in the initial report on national practices was that there did not seem to be significant information on this aspect. In fact, only one or two countries made any response on the questionnaire; maybe the questionnaire was not good enough, but except that, it would be interesting to learn specially in this context I suppose in America you do have defect retrieval systems, in the U.K. we have modest simple ones but I do find that for the future, when you consider that for safe operation of reactors, all their life time they will accumulate thousand reactor-years of operating information concerning defects and concerning operating information, in what way is that information to be processed, in what way is that information to be used, not only in the context of providing operating controls but also in the context of future design?. This is a subject which perhaps ought to be added to this point on operation because it is a matter of recording operating information brought in terms of defects and in terms of problems.

VOLGENAU: With respect to Mr. Gronow's comments I would certainly endorse them by saying that in the U.S., not only each year we are accumulating sixty to seventy operating reactor-years of experience, all aspects of
non compliances, incidents, events, but also each year we are accumulating nearly 100 reactor-years of construction experience. So we have embarked on a rather ambitious program to somehow or other, try to correlate and to collect, examine, correlate and react to all this data which we are generating. It is one thing to collect the data, but it is quite another to sort it out and make some type of sense out of it. And third, given that you can do those first two problems associated with the data, then one must find a way of reacting to the data. In our case, it is a question of trying to use the data in some way to allocate our most precious and scarce research which is the inspecting man-power.

CALORI: May I perhaps put a question to Mr. Gronow. In your paper you referred to the old magnox plants in the safety review in the U.K. Could you give us some more details, specially from the point of view of inspectors.

GRONOW: I already explained it in the paper. There is of course a continuous life of the plants in the context of the ageing process. Now some of the reactors have approached twenty years life-time and we have had licencees who gaily said that these continue for another ten years or twenty years. We have set up a special safety assessment team to undertake the task of examining reactors in their age sequence, starting with the older reactors; first of all, to look at those in the context of present day knowledge, not necessarily with the objective of having backfitting requirements, but with the objective of seeing that they can continue for a certain period of operation without any additional restraints. Certainly, the maintenance problems and other aspects of replacement and the fact that the older reactors are generally smaller, may lead to shut down or terminate their operation simply because of an economic situation, but of course, they are all paid for; it is simply a question of the
amount of power produced, the amount of maintenance and replacement causes we have in that area. We have to be satisfied that they are, in fact, safely operated. This will include examination of pressure vessel integrity in the context of longer operating life, and it will include the examination of the reactor's internal components, looking at data, in the case of magnox stations, about their graphite, looking at data in relation, perhaps, to the operating performance under transient conditions, and a general review of the whole system in the context of initial design safety assessment up-dated as it is on a frequent basis.

CALORI: Any other comments?

STADIE: Maybe, I could share with you a suggestion which I heard at a recent meeting concerning general safety in the U.S. It was related to the black box, which is now becoming usual in all commercial aircraft in the Western World. Now, it is suggested why regulatory authorities have not installed this kind of boxes in nuclear power plants? I do understand it will be a big box because of the number of parameters you want to monitor. But let us go a little bit further, maybe in the future, future land, there will be a centralized regulatory organization held up electronically to all the reactors and have instant monitoring.

CALORI: We now pass to the more specific papers, one by Mr. Odoni, on leak tests and filtering tests on Italian stations another by Mr. Lespiauc about the pressure test on primary coaling pressure boundary of nuclear power stations. I think that both the panel and the audience could comment on it.

DOPCHIE: Mr. Odoni and the Italians are using a way of filter testing which is rather discussed. The usual argument against it is that, as Mr. Odoni said, he did not really test the efficiency but rather the leak
tightness of the filter. So, as Mr. Odoni said, you need to have a capsule which is put in the same condition as the filter and which you can test in the laboratory. There are questions to be raised on the history of this little filter you got there, but the main difficulty is that the operation is time consuming and involves many inaccuracies in the way you are going to calculate finally our efficiency. The other method, of course, is just to send molecular iodine, normal iodine and you can send methyl iodide through your filter and you can test the efficiency immediately in that way, the objection there is that you are releasing iodine. You can use different forms of iodine; we use iodine 131. The quantity that you are releasing can be made extremely small, for instance the amount that we put upstream of the filter, and not downstream, is well below the instantaneous release limit that we have in our construction permit and in our operating licence. The test is remade, soon enough you discover that you don't need to make the test with molecular iodine anymore since it becomes obvious that the determinant test is with methyl iodide. So, it is an easy straight-forward test that we follow and I would wonder why some other people, and the Americans, and the Italians don't go to the straightforward easy method.

LEWIS: About every two years, iodine absorption plant tests are carried out on nuclear power plants and we find this to be necessary because the ageing effect on the charcoal absorbent seems to demand this type of tests. They inject methyl iodide, something like 10 mCi, upstream of the filter and they measure the efficiency of the filter by relating the activity downstream to what it is upstream measured by iso-kinetic test methods, and from this we expect to get a decontamination factor of 1000, which is an efficiency of 99.9 for a retention time of the iodine of ~0.5 of a second in the bed under normal discharge conditions for ~5 tons CO₂/h. The tests I have said are done to prove the effectiveness of the absorption
capacity of the iodine plants. We do find that it is not always the charcoal absorption capacity which is failing, but, due to changes in the conditions of the bed, the stability of the packing goes down or the packing factor is reduced or increased. Anyway, the charcoal is re-disturbed and the main cause of loss of efficiency is not in the absorption capacity of the charcoal but in the instability in the bed, and it requires the filter to be refurbished. So, this is an important thing which we expect the licensees to do on a regular basis and if they do it, just try to shut down when they can use the system of blow-down of the reactor, and he can use the blow-down of the reactor under normal or as near normal operating conditions as possible. I hope that will help the conference to understand this problem.

COURVOISIER: This probably leads us into the domain of radiation protection. We haven't heard very much about radiation protection inspections, just a few remarks here and there, and I wonder always whether we have forgotten it because of ECCS problems or whatever you have there, or engineering problems, but the whole business has started by the fact that radiation is involved and radioactivity too. In Switzerland, we feel that the operators need more inspection on the radiation protection side because they are weaker on this side than they are on the mechanical and electrical engineering side. Does anyone feel in the same way? I'm afraid not, because otherwise we would have heard much more about radiation protection inspections.

DOPCHIE: Well, Mr. Courvoisier, I am entirely with you. In our system we have divided the nuclear power stations in seven parts, seven technical parts, and we are making a visit once every two weeks covering one of these parts. This visit incidentally covers also other parts that have to be discussed because of the previous visit, not because of other reasons. In this way, we cover the total power station four times a year,
we have exactly 26 visits. One of these visits concerns radiation protection and normal security, and other visits cover radiation measurements, and there I go entirely with you. In radiation measurements we have found great inaccuracy in the assessment of releases. For instance, we have checked part of the instrumentation in one of those plants and it had to be torn-down and replaced because of obstruction in the small ducts, the little pipes, that appeared to be larger than what had been anticipated in the design. In many of those equipments, and quite often, this problem of inaccuracy appears. We have this problem and we believe it is an important point to be covered in our continuous inspections. I told you that we had a systematic visit every two weeks but our activity for the power station in operation goes far beyond that, and the main part of our activity is not the systematic inspection and the reports that go with it. There are other visits and other problems that we encountered that make the main part of our in-service inspection.

GRIER: Radiation protection is a part of our inspection program. We define an overall program to be accomplished during a year, specifying certain frequencies in particular areas, so it is not based on the number of inspections but rather accomplishing the total program.

CALORI: Mr. Clément will contribute to the discussion on this point.

CLEMENT: Peut-être un commentaire sur ce problème de radioprotection. Il est bien évident qu'il est important de savoir ce que chaque personne reçoit comme rayonnement, et les gens qui s'intéressent à la santé du personnel ne manquent pas de demander et de suivre de très près tout ce problème. Et bien, il y a un autre aspect que je voudrais mentionner, c'est l'intérêt non pas de connaître ce que chaque personne reçoit, mais de connaître les doses de rayonnement qui son distribuées, si je l'ose dire, pour un travail donné; et là, les ingénieurs, les gens qui s'occupent
de sûreté nucléaire ont certainement un intérêt à connaître ces doses et probablement ils en tireront des avantages, ils constateront, peut-être, que tel poste de travail donne des doses très supérieures à ce qu'ils attendaient, à ce qu'était prévu lors de la conception, et ça peut faire déboucher sur des modifications, soit dans l'installation même, soit dans les procédures d'exploitation.

G. BERNAL: I should like to make some comments. I agree completely that radiological protection makes part of the inspection work. In this sense, I should like to comment on our procedure. When we make a routine inspection, we always pay a visit to the radiation protection service of the power station health physics. This visit is mostly done to check that the personnel radiological records are up-to-date. This job is purely administrative and it is not sufficient. Then, we also visit and check, rather often, that the norms established are followed by every one. I must say that the people do not realize our presence, although the heads of the power station are aware of it. We usually choose a place where we can check that the people leaving the controlled zone meet the specifications. We also make several checks on the air sampling equipment installed around the station to see that they are functioning and the values are being recorded. There is also another point which I consider to be very important, and this is the sampling of water, slurry, alga, fish, etc., in the surroundings of the power station. The power station must do a study of all this and send it to us.

There is another interesting point which is mandatory for our power stations, this is an emergency drill which should be done at least once a year. To this emergency drill we send three inspectors, one of them being an expert in radiation protection. We send three inspectors because we consider that they should be located in different areas of the station.
Generally, one of them stays in the control room and the others in the surroundings of the power station. The emergency drill can be more or less complete, it depends. Lately we have done one test in "José Cabrera" power station, where people of the village were evacuated and we maintained a strict control of all the personnel that should move within the power station and this was perfectly accounted; besides, we changed, in agreement with the head of the station only, the plan proposed by the power station to the administration. In this respect, I remember one of these tests where I was present with Mr. Buergo and he proposed to the head of the power station to say to the personnel that the entrance of equipment to the building was out of service just to see the reaction of the personnel. The reaction was very quick and the personnel left the building through the emergency door which was located 25m upstairs, when we arrived upstairs my liver was close to my mouth due to the climbing speed. This example is just to show you that we attach a big importance to radiological protection during routine or emergency inspections.
SESSION V, SPECIAL ASPECTS OF REGULATORY INSPECTION.
Session V: Special aspects of regulatory inspection

E. Volgenau: Session Chairman
W. S. Gronow: Scientific Secretary

Principal conclusions and problem areas:

Session V addressed two subjects: inspection of nuclear fuel transportation and public information aspects of nuclear safety inspection.

With regard to the first subject, it was noted that there are two important aspects with respect to nuclear fuel transportation - those associated with physical security (that is, protecting shipments from malevolent actions on the part of individuals) and those associated with public health and safety.

The majority time in session V was devoted to public information aspects of nuclear inspection and the following conclusions can be made:

1 - public involvement in the regulatory process continues to grow in most countries

2 - there is a corresponding growth in the public information activities of most inspection organizations. For example, in some countries inspection records are available to the public and inspectors are called upon to give their views in public proceedings.

Proposals for future work:

In view of the conclusions above, it is clear that further exchanges are desirable among member countries concerning developments in the area of public information.
THE ENFORCEMENT PROGRAM OF THE
NUCLEAR REGULATORY COMMISSION IN THE
UNITED STATES

Harold D. Thornburg
United States Nuclear Regulatory Commission
Washington, D. C. United States of America

The enforcement program of the United States Nuclear Regulatory Commission consists of a clearly spelled out, evenly applied program of deterents which escalate according to the nature of the offense and the past history of the licensee's noncompliances. Ninety-eight percent of all enforcement actions are normally handled by the five Regional offices. Only one percent of noncompliances have been classed as violations where significant safety consequences occurred. A strong and timely enforcement program is essential to insure that licensees fulfill their obligations to protect the public and the environment.
The NRC enforcement effort consists of a clearly spelled out, evenly applied program of deterents which escalate according to the nature of the offense and the past history of noncompliance. A comprehensive statement of this enforcement policy was distributed to all NRC licensees on December 31, 1974 and to all new licensees since then.

From an enforcement standpoint, each item examined during an inspection or an investigation falls into one of four categories (Figure 1): (1) it is acceptable; (2) it does not comply with Commission rules and regulations or specific license conditions; (3) it deviates from a licensee commitment which is not a regulatory requirement; or (4) more information is needed to determine that the finding lies in one of the other three categories. Furthermore, each item of noncompliance is categorized to express its relative significance.

Since the NRC places great emphasis on the licensee's program to identify items which need to be corrected, enforcement action is usually not taken for noncompliance items which are identified by a licensee's internal audit program -- providing the licensee adequately corrects the problem.

NRC attaches considerable significance to noncompliance items which we directly identify. In view of the requirements for multiple levels of inspection and audit under a licensee's quality assurance program, NRC identification of a noncompliance item carries with it broader implications regarding the effectiveness of the licensee's quality assurance program. For this reason, we require the licensee not only to correct the particular problem identified, but also to correct the deficiencies in the quality assurance program which allowed this situation to exist.

The U.S. NRC enforcement program can be illustrated by briefly following the sequence of events that usually take place within the inspection-enforcement process. First, an inspection is made by the inspector. The results of the inspection are discussed with licensee representatives at an exit interview on the last day of the inspection. The results of the inspection are also documented through a formal report that is sent to the licensee within twenty days after the inspection. The findings of the inspection fall into one of the four categories shown on Figure 1. Any unresolved items must eventually fall into either the acceptable or nonacceptable categories upon receipt of additional information.

If a noncompliance is found, it must be classified into one of the three levels of severity illustrated on Figure 2. Briefly, these classifications are:

- Violations - Items where significant safety consequences occurred or could have occurred because of the noncompliance.
- Infractions - Items where significant safety consequences could have occurred but where safety margins (of protective systems) still existed.
- Deficiencies - Items that do not have direct safety significance.

A Notice of Violation in the form of a letter is sent to the licensee with the inspection report. The licensee must respond within a given time frame,
usually twenty days. The response, which is sent to the five NRC Regional
Offices, must indicate (1) how the licensee intends to correct that item
of noncompliance; (2) when corrective action will be taken; and (3) how
the licensee intends to prevent similar occurrences in the future. The
Regional Office reviews this response and either approves or disapproves
the proposed licensee actions. (Disapproval requires that the licensee
respond to the Region's objectives). In addition, the licensee's plans
and actions for correction are reviewed at subsequent inspections to insure
that corrective action has, in fact, taken place.

For serious items of noncompliance (usually violations or a combination of
infractions over a period of time), the enforcement sanctions are escalated.
These escalations are usually preceded by additional inspections or investi-
gations that probe more deeply into the licensee's management processes.
An Enforcement Conference or management meeting may be the next step. This
is a meeting of the senior staff of the Region usually including the Regional
Director and the senior management of the utility. The President of the
utility often attends this meeting. At the meeting the particular problems
are discussed but the overall management of the facility is also examined.
The licensee usually proposes actions to correct the problems. These actions
are then summarized in an Immediate Action Letter from the NRC Region to
the licensee. These actions become commitments that are subject to future
inspection review.

Commitments can also result from other situations, such as a new Regulatory
Guide or a Bulletin. In such cases if the licensee fails to comply with his
commitments he can be cited during an inspection for a Deviation. The licensee
must respond to a Deviation citation in a fashion similar to a citation for
noncompliance.

The steps discussed above usually are taken by a Regional Office. In most
cases these enforcement measures are sufficient to bring about corrective
action by the licensee. Continued failure to fulfill commitments or correct
items of noncompliance can lead to escalated sanctions such as Civil Penalties
or Orders. These higher sanctions require the involvement of the Headquarters
of the Office of Inspection and Enforcement, as well as other NRC offices.

As shown on Figure 3, Orders cover a number of categories: Show Cause; Cease
and Desist; license suspension; license modification; revocation of a license;
denial of license renewal, and rescinding of previous orders. Orders are the
most serious sanction available to NRC and obviously can affect the licensee's
operation significantly.

Due to their significance, these higher sanctions require a thorough adminis-
trative/legal process. Figure 4 illustrates this process for the imposition
of a Civil Penalty. The process starts when the Region recommends that a
Civil Penalty be issued. The inspection or investigation findings are
reviewed by IE Headquarters staff. If the Headquarters concurs in the Civil
Penalty, a Notice of Violation is sent to the licensee with the proposed
Civil Penalty before the letter is sent. The licensee is informed by tele-
phone and the Commission is informed five days prior to the issuance. A
public announcement is made two days after the letter is sent to the licensee.
The licensee has 20 days to respond from the date of receipt.
Depending on the licensee response, the Civil Penalty can be dismissed. If the civil penalty is not dismissed, the process continues by the issuance of the Order to impose a Civil Penalty. The licensee may pay the penalty without the issuance of the Order. In this case the process terminates. Once the Order is issued, the licensee has 20 days to pay the penalty or request a hearing. The Commission is informed when the Order is issued. If the licensee does not respond to the Order, the matter is referred to the Department of Justice for collection. The Department of Justice has the authority to mitigate or remit the penalty depending on his interaction with the licensee.

Should the licensee request a hearing, a Notice of Hearing is drafted with the concurrence of the Executive Legal Director (ELD). The Hearing Notice is signed by the Commission. The Hearing can result in dismissal, mitigation, imposition, or remission of the penalties. The licensee can appeal the Hearing Board's decision. The case is then referred to the Appeal Board for a final Commission ruling. The licensee always has the right to seek redress in the Civil Courts.

No Orders imposed by the NRC has gone to hearing so far, although there are three cases pending that may require hearings. With regard to actual enforcement experience, NRC has about 11,000 licensees. Five percent of these are reactor licensees. During the past year 6,000 inspections were conducted with approximately fifty percent devoted to reactors. Forty percent of these inspections found items of noncompliance. Of the noncompliances, only one percent were Violations, sixty percent were Infractions and the balance were Deficiencies.

When noncompliances were found in the inspections, ninety-eight percent of the enforcement actions were completed by the Regional offices. The two percent referred to Headquarters, usually resulted in the higher sanctions discussed above. In 1977, actions taken by Headquarters included 27 Notices of Violation, 25 Civil Penalties, and Orders to five different licensees. Six different utilities received Civil Penalties for items ranging from exceeding release limits to an unplanned criticality. No Orders were issued to utilities during 1977.

In summary, our experience indicates that compliance by NRC licensees is generally good. In those cases where enforcement action is necessary, our system has assured that the situation was corrected.

* * *
THE OPERATION OF NUCLEAR POWER PLANTS
AND THE PRINCIPLE OF PUBLIC ACCESS TO
OFFICIAL RECORDS

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Sweden
The licensing authority for nuclear power plants and other nuclear installations in Sweden is the Nuclear Power Inspectorate. When the government gives a site permission to a utility, it gives it under the condition that the utility shall follow all prescriptions given by the inspectorate on design, construction and operation of the installation which are of importance to the safety. One prescription which the inspectorate then gives is that it should be continuously informed about the operation of the plant and especially about all kinds of abnormal occurrences.

The major interests for the inspectorate in collecting this information and analyzing it, is to

- give direction for the control and inspection of plants in operation and to give a basis for changes in those plants

- give a feedback of information from plants in operation to those under construction or design.

These purposes of the collection of information from the utilities is dealt with in detail in other Swedish papers to the Specialist meeting.

However, the fact that the Inspectorate gets information about the operation of nuclear installations has an interesting consequence due to the Swedish principle of public access to official records.

Any document which has arrived to an authority in Sweden is considered as an official document. This is the case independent of the form of the document: a hand-written letter, a memorandum, a computer tape, a formal or informal message and so on. The document is official also already before it has been registered in the files of the authority.

Documents produced within an authority are considered official at the moment when they leave the authority, or if that is not the case, when the decision dealt with in the document has been taken or when the document is brought into the file of a case.

Any Swede – and also, as a matter of fact, any foreigner has got the right to see, read and copy any official document. There are of course exceptions, but they are very few and concern matters of importance for the national defence, the work of the police forces, information of commercial interest for a private company. A person, company or organization which makes a document available to an authority has no right to demand that the document should be dealt with as not being official (with the exceptions mentioned).
As a consequence of the principle of public access to official records, the information given by utilities to the Nuclear Power Inspectorate about the operation of a nuclear power plant, is official. Therefore any person has the right to contact the Inspectorate and ask for all available information about any reactor. As the Inspectorate prescribes that it shall be continuously informed about the operation and especially about all kinds of abnormal occurrences, this information is available to anyone who is interested in it.

To what kind of information from the operation of the power plants does the public have full access? My Swedish colleagues have previously during this seminar described our reporting system. They have talked about the daily reports on normal operation and about the special reports on scares and incidents. All information of that kind should be made available for anyone asking for it. The same is the case for the reporting from the utilities on specific items as well as reports from outside consultants. When reactor vendors report to us there might be commercial interest involved so that the information could be classified due to commercial reasons. You might think that the principle of public access to official records will make life difficult for the authorities and of course also for utilities and vendors. For the authorities it is certainly not so. On the contrary this principle and its consequences simplifies the work of the authorities as concerns its contacts with the public, with the press and also with utilities and vendors. This is because there is very little room for discussions whether a piece of information should be kept secret or not, whether a report might be shown or not shown.

When the public debate about nuclear power started in Sweden some years ago there was no great interest for the Nuclear Power Inspectorate and its work. We were contacted by journalists when they had found some interesting news concerning incidents in utilities but our work was not very well known among either the journalists nor among politicians and of course not among the public in general. Journalists were very interested in finding out what awful things happened inside the power plants and they were, as I see it, rather suspicious against the utilities who they believed tried to conceal important information. At that time the reporting system of the Nuclear Power Inspectorate was not yet implemented so we had a bad readiness for giving information about what happened in the plants and to give our views on what happened.
I have already mentioned journalists several times without saying very much about the public in general. The reason is that the part of the public which is in the first place interested in the information about what happens in the power plants is the press, the radio and the television. It rather seldom happens that we are contacted by the interested layman who wants information about the operation of power plants or other questions of interest for nuclear safety.

When we began to use our reporting system for operation, incidents and scrams we soon found that we had got an instrument for giving reliable information about safety matters of the reactors. A short time after the occurrence of an incident we knew the details of it and could form our own opinion of it. We also got a better overview of the safety record of the reactors. At about the same time we started the publication of the quarterly reports which have been described earlier by Mr. Nilsson. They were distributed not only to the press but also to authorities and to ministries, to members of the Parliament and to the political parties. The first quarterly report came in April 1975 and covered the first quarter of 1975. The date was well timed for the discussions foregoing the decision in May 1975 by the Parliament on the energy policy for the next three years. We very soon noticed that the quarterly reports were considered to be serious. They were quoted in the press and I would say - without having any statistics on it - that our contacts with the press and the public became more frequent than before. There is no doubt that the numbers of articles in the newspapers about incidents in the reactors have diminished since the quarterly reports started to be published. That is certainly the fact for articles with incorrect information. I would not say that I am sure that this is entirely an effect of the quarterly reports, there might be other reasons, but we are anyhow sure that they have had a positive effect on what is written about nuclear safety. I have also the impression that they have had a positive effect on the public image of the Nuclear Power Inspectorate. We are now more known to politicians, to the public and to the press. It is my belief that the quarterly reports have been of a great importance for the fact that the public has a certain confidence in the nuclear safety authority. I will not at all say that a reporting to the public of that kind, grounded on a principle of public access to official records, is the only or the best way to create confidence between an authority and the public, but it has anyhow been to a great help for us.
I will give you a few practical examples on how our contacts with the public is handled.

Once a week we are visited by a journalist from the Swedish news agency (Tidningarnas Telegrambyrå, TT). He looks through our registers of incoming documents and asks to see what he finds interesting. Our rules are that we shall meet such a requirement as long as it does not disturb our normal work. He will then be shown for instance incident reports, consultants reports, letters from us to the utilities giving conditions for the operation of the plants and so on. He has the right not only to look at the documents but also to copy them, although he could not demand that the authority should take the costs for the copying. This journalist is also very interested in a bulletin board in our office where we show the daily reports from the power plants. Contacts have been established between him and the staff responsible for the different power plants and from them he gets complementary information. Other journalists also come more or less regularly to our office, not only to look at actual reports, but also to keep in touch with general problems of nuclear safety as described in the technical press and to discuss those problems with us.

I will give you one more example. About one year ago the newly elected Swedish government appointed an Energy Commission which was given the very heavy task to prepare for the coming energy policy decision of the Parliament in 1978. The commission should give to the members of the Parliament and the political parties a background information about different energy production options and their consequences on the economy, the environment, the safety and so on. There is an Expert Group for Safety and Environment working for the commission. In this group the Nuclear Power Inspectorate is represented. The expert group wanted to do a reactor safety study of Rasmussen type for one of the Swedish nuclear power plants. One such study was already under way, and is still going on, sponsored and ordered by the Nuclear Power Inspectorate, but the expert group and the energy commission wanted to do a similar study with an "independant" way of looking at the problem. Therefore a former NRC-employee was engaged as a consultant to review the differences between working methods of the licencing authority in the US and in Sweden. Furthermore, three former General Electric employees were engaged to make a safety assessment of the Barsebäck plant along the lines of the Rasmussen study. These consultants are critical to many parts of the Rasmussen study and will in their own work
try to evaluate factors which they think the Rasmussen study has overseen. As I said before the Nuclear Power Inspectorate is represented in the expert group which decided to use these consultants. We have a positive view on their work. We think that it will be a valuable contribution to our own studies of the safety of the Barsebäck plant. As I said earlier not only any Swede but also any foreigner has the right to look at our records. Therefore there would be very few problems, at least theoretically, for the consultants to get all the information they needed. They might have come to us, without even mentioning their names, and asked for all information available. However, the Nuclear Power Inspectorate as a Swedish authority has been ordered by the government to give all help to the Energy Commission. Consequently we had to do more for the consultants. We also very soon realised that it was in our own interest to give as much help as possible to them. It is not only so that we are those who have the information about the Swedish plants, but also that we are those who have the correct interpretation of the information. This interpretation is of special importance in the case of these consultants, as most of the documents concerning the Barsebäck plants are in Swedish. Our practical solution was to let the consultants work in our offices during some weeks last summer. There we participated in collecting the documents for them, in the interpretation and in the discussions about these documents. This case was certainly one where we had great help of the principle of public access to official records. We never came into the difficult situation to decide what information it would be advantageous for us to give and what information we should keep to ourselves. In a few cases there were documents of interest for the consultants which were classified due to commercial interests of the Swedish reactor vendor. The vendor had a very obliging attitude, however, and allowed the consultants to look also at these documents. We certainly know that in the reports of the consultants there will be criticism towards us, but at the same time we know that this criticism will not be that we have tried to conceal any information to them.

An interesting question is of course: how do the utilities and the vendors look at the public access to almost all information which they give to the authority? Of course they cannot do much about it, as well as we cannot, but do they find it advantageous or disadvantageous? I shall not answer for them but let me just give my personal impression: also for them the principle of public access to official records makes life easier to live in the long run.
PUBLIC INFORMATION ON NUCLEAR SAFETY AND INCIDENTS

AT NUCLEAR INSTALLATIONS IN THE UK

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In recent years public interest in the safety aspects of the use of nuclear energy has been increasing in the UK as in other countries. The Government considers public involvement on this subject to be important and has taken action to promote and encourage public debate. As a result of a Government requirement, the Health and Safety Executive (HSE) now publish a quarterly statement which gives particulars of incidents at nuclear installations reported to the HSE under the Nuclear Installations Act 1965, Dangerous Occurrences Regulations and under conditions attached to nuclear site licences granted under that Act.

The Paper describes the range of incidents covered in the quarterly statement and the present state and background of the public debate on nuclear energy in the UK.
1. **INTRODUCTION**

In recent years public interest in the safety aspects of the use of nuclear energy has been increasing in the UK as in other countries. The Government considers public involvement in this subject to be important and has taken action to promote and encourage public debate. As a result of a Government requirement, the Health and Safety Executive (HSE) now publish a quarterly statement which gives particulars of nuclear incidents at civil nuclear installations which have a bearing on safety and health.

The formulation of nuclear policy involves consideration of a wide range of interests including public acceptability. This paper describes the responsibilities of the various organisations involved and the roles of the bodies with regulatory functions. The background to requirement for publication of incidents at nuclear installations, and the range of incidents covered in the quarterly statement is also discussed. Reference is made to information made available on nuclear safety from Government and other sources in the UK in the context of the public debate on nuclear energy.

2. **NUCLEAR POLICY**

Successive Governments have recognised the fundamental importance of the safety, environmental, and public acceptability aspects of all nuclear activities in the United Kingdom. A valuable safeguard is the separation of the different responsibilities that arise out of the development of nuclear power.

The Department of Energy's responsibility is to consider on what scale nuclear power could contribute towards the nation's needs for securing economic and reliable supplies of energy; the acceptability of utilising it on that scale; its place in wider energy strategy; and what systems justify a commitment of UK resources to develop and exploit them.

Subject to these broad policy questions, the development and use of nuclear power is the responsibility of the United Kingdom Atomic Energy Authority, British Nuclear Fuels Ltd, National Nuclear Corporation and the Generating Boards.

The responsibility for preparing the legislative framework incorporating standards to protect the environment, the safety and health of workers and the public, and ensuring that they are met, is placed by Acts of Parliament on regulating authorities which are constituted quite independently of the Department of Energy and of the nuclear and electricity industries. A diagram showing the various inputs and considerations in the formulation of nuclear policy is shown in Figure 1.

3. **REGULATORY FUNCTIONS CONTROLS AND RESPONSIBILITIES**

Fundamental to the public acceptability of nuclear power is the application of very strict safety criteria. Much more stringent standards are applied to nuclear power than to other energy technologies. This has to a large extent arisen because nuclear power is a new technology the potential dangers of which have been recognised from the start. Safety standards have been laid down but are reviewed continuously in the light
of scientific and technical developments. The aim of nuclear safety policy is to eliminate the possibility and potential consequences of accidents as far as is reasonably practicable. Similarly, it aims to keep levels of exposure of people to radiation below the upper limits recommended by the International Commission on Radiological Protection (ICRP), and accepted internationally, but at the same time to keep actual exposure as far below these limits as is reasonably achievable.

4. **NUCLEAR SITE OPERATIONS**

The safety control of nuclear installations is governed by the Health and Safety at Work etc Act 1974 and the associated relevant statutory provisions of the Nuclear Installations Act 1965, under which no commercial nuclear installations may be constructed or operated in this country without a licence granted by the Health and Safety Executive (HSE). The main types of installation covered by this legislation are nuclear power stations and sites used for the manufacture of nuclear fuel, the reprocessing of irradiated fuel and the storage of radioactive waste. Licence conditions in the interest of safety are imposed and enforced by the Executive's Nuclear Installations Inspectorate (NII) which exercises strict surveillance at all licensed sites. Sites operated by the United Kingdom Atomic Energy Authority and by Government Departments are not subject to licensing but are required under the 1965 Act to meet the same standards as are imposed on the operators of licensed sites. The operation of all these sites, licensed or not, is subject to the obligations imposed by the Health and Safety at Work Act.

The Health and Safety Commission and its Executive, though constituted as quasi independent bodies outside the Government machine, are ultimately responsible for the performance of their functions to the 'Secretary of State'. In the case of nuclear health and safety, it is the Secretary of State for Energy, or for Scotland as appropriate, who is answerable for it to Parliament. Effectively while the Secretary of State for Energy has no direct responsibility for promoting and developing nuclear safety he is ultimately responsible for the way in which this function is carried out by the Commission and Executive.

5. **PROTECTION OF THE ENVIRONMENT**

Responsibility for disposals of radioactive waste from licensed nuclear sites and those of the UKAEA rests in England with the Secretary of State for the Environment and the Minister of Agriculture, Fisheries and Food; in Wales both the Secretary of State for Wales and the Minister of Agriculture, Fisheries and Food; and in Scotland with the Secretary of State for Scotland. These Ministers, under the provisions of the Radioactive Substances Act 1960, authorise and control the extent to which, and the conditions under which, radioactive substances may be disposed of in the environment. This responsibility relates, for example, to the control of discharge of liquid or gaseous radioactive effluent in the course of normal working of nuclear installations, and to the disposal of solid radioactive waste.

6. **TRANSPORT OF RADIOACTIVE SUBSTANCES**

The conditions of carriage and regulatory requirements for the transport of radioactive substances in the UK are based on the model regulations set out by the International Atomic Energy Agency (IAEA)
in 1973. In the UK these standards are controlled by the Dept. of Transport.

7. **HEALTH PROTECTION**

The national point of authoritative reference on radiological protection matters is the National Radiological Protection Board (NRPB) which was established in 1970. Together with the Medical Research Council (MRC) it provides advice on the biological effects of radiation, radiation standards and radiological protection. It carries out research and development, for example, research on the effects of plutonium on man, and studies of the health records of radiation workers.

The responsibilities of the regulatory authorities are shown in Figure 2.

8. **PUBLIC DEBATE ON NUCLEAR ENERGY**

From the start of the UK civil nuclear power programme in 1965 there have been substantial public discussions including Parliamentary debates, based on Government White Papers and other publications, and statements and publications by the nuclear organisations. These have covered all aspects including safety, and have been fully reported and discussed in the media and by independent fora. However in the past two years the public debate on the nation's future nuclear power programme and associated issues such as the reprocessing of waste nuclear fuel has gained impetus.

8.1 **PARLIAMENT**

There have been several wide ranging debates on nuclear energy matters in both Houses of Parliament. The debates have covered inter alia nuclear reactor policy, nuclear energy policy and nuclear safety and these have been published in Hansard. Parliamentary Committees have also devoted time to nuclear matters. The Select Committee on Science and Technology reviewed the thermal reactor systems proposed for use in the UK, and in later sessions the SGRWR programme, and took evidence from a wide range of interests including the HSE, organisations responsible for the development and construction of nuclear power plants and other interested independent groups such as the FOE and published its evidence. The Scrutiny Committees of the House of Commons and House of Lords on the European Communities have considered Community proposals including a Council resolution on technological problems relating to nuclear safety. They have published their conclusions and reports on the subsequent debates in Parliament were published in Hansard.

8.2 **PUBLIC FORA**

The Secretary of State for Energy has initiated important discussions on nuclear and general energy matters, two of which covered important nuclear policy matters. In December 1975 a debate was held in Church House Westminster to discuss the proposal to import Japanese nuclear fuel for reprocessing at Windscale. The case for the proposal was put by British Nuclear Fuels Ltd (BNFL) and that against by the environmentalist groups called the Friends of the Earth and Half-Life. At the same venue in June 1976 the Secretary of State chaired a National Energy Conference attended by the chairmen of the energy industries, Trades Unionists, distinguished guests from overseas including the EEC
Energy Commissioner from Brussels. More recently (May 1977) the Secretary of State heard the views of prominent academics, representatives of the electricity and nuclear industries, members of Parliament and environmentalists on nuclear as well as general energy questions at an informal seminar at Sunningdale. The conclusions were published.

8.3 ROYAL COMMISSION REPORT

A major contribution to the public debate was the 6th report of the Royal Commission on Environmental Pollution, entitled "Nuclear Power and the Environment" (Cmd 6618). The Commission was appointed "to advise on matters, both national and international, concerning the pollution of the environment; on the adequacy of research in this field; and the future possibilities of danger to the environment". The general conclusion of the Commission following its study of nuclear power was that the abandonment of nuclear power would be neither wise nor justified. One of its recommendations was that a special procedure for public consultation should be established in respect of major questions of nuclear development to enable decisions to "take place by explicit political process". The Government's response to the Commission's report (Cmd 6820) accepted the need for a proper framework for wider public debate and the most suitable kind of special procedure to achieve this is being considered. The Government has recently announced that a planning inquiry will be held before a decision on the first commercial fast reactor is taken.

8.4 WINDSCALE INQUIRY

Currently a public inquiry is being held into the proposal by British Nuclear Fuels Ltd (BNFL) to construct plant for reprocessing oxide fuels at Windscale. The inquiry which started in June may last for about four months and the evidence taken from a wide variety of interests will make an important contribution to the public debate on nuclear matters. All interested parties who wished to give evidence have had the opportunity to do so and the NII and Government Departments concerned have been called to give written and oral evidence. Accounts of the progress of the inquiry appear in the daily press, technical and other journals, on radio and television.

8.5 MEDIA

During the past year there has been greater interest from the media on nuclear subjects, including TV features on nuclear power and nuclear safety. One programme included a coverage of the rehearsal of the emergency plan at a nuclear power station in which a representative of the Nuclear Installations Inspectorate took part.

8.6 SAFETY OF CONVENTIONAL ENERGY SOURCES

A list of questions on the safety of non-nuclear energy sources and power production has been raised by staff at the Dounreay Experimental Research Establishment with a view to putting the UK nuclear safety record in perspective. The Health and Safety Commission have been asked to prepare detailed replies and to report to Parliament in due course.
8.7 OTHER INFORMATION

The desire on the part of the Government for more open public debate on nuclear safety matters was also reflected by the publication last January of an HSE report replying to a series of questions on nuclear safety addressed to the Nuclear Installations Inspectorate (NI) at the initiative of the Secretary of State for Energy. The report entitled 'Some aspects of the safety of nuclear installations in Great Britain' answered 19 questions on the safety of the fast reactor and its fuel cycle from the Secretary of State himself who had previously announced his intention in the House of Commons and invited Members of Parliament and others to submit questions. As a result a list of 23 questions was submitted by MPs and a list of 45 questions was published by the Society known as the Friends of the Earth. Most of the questions from the MPs were of a fairly general character unlike those from the Friends of the Earth which were of a much more detailed character and sought to elicit specific technical responses including details of previous incidents at nuclear installations. The report was made available by the Secretary of State to Parliament and published in full as a contribution to the public discussion on nuclear energy. Other reports made available to the public on nuclear safety include the summary of the results of studies by the Nuclear Inspectorate into the safety of reactor systems new to commercial operation in the UK and by the UKAEA on pressure vessels.

8.8 FUTURE DEVELOPMENTS

In order to assist and promote this wide-ranging debate on all aspects of nuclear energy policy the Government is arranging for the publication of a series of papers, in a form comprehensible to laymen, of the results of research and development on radioactive waste management, research into the effects of radioactivity and other more general nuclear energy topics. By all these means the Government aims to ensure that in future major decisions on nuclear energy policy will be taken after public debate and detailed discussion.

9. REPORTING AND PUBLICATION OF INCIDENTS AT NUCLEAR INSTALLATIONS

The only published information on incidents at nuclear installations in the UK until 1977 was contained in reports of the proceedings of Parliament (Hansard), Government Command Papers, in press statements released by the plant operators or in reports published by technical staff. The information in Hansard records the Government's response to questions by Members of Parliament on particular incidents and only two Command papers have been published on accidents or incidents at nuclear plants. The most recent of these dealt with the incident in Building B204 at the Windscale works of British Nuclear Fuels Ltd on 26 September 1973 and the earlier paper with the accident to the No 1 pile at Windscale in 1957. Publication of reports of incidents by the plant operators is at their discretion.

However, in December 1976, the Secretary of State for Energy announced in Parliament that he had arranged to be informed of any incident at nuclear installations within his sphere of responsibility. This requirement arose from a report of a leak at a radioactive waste silo at the time when the Government was giving consideration to the
planning application from British Nuclear Fuels Ltd to expand the reprocessing capacity at its Windscale Works. The reporting requirements did not specify the range of incidents to be covered and following discussions with the operators of nuclear plants the Secretary of State for Energy made the following statement on 2 February 1977:

"Licensees of nuclear installations are required by the Nuclear Installations (Dangerous Occurrences) Regulations 1965 to report immediately to the Health and Safety Executive the following occurrences:

a) any release of radioactivity or toxic substances causing or likely to cause death or serious injury;

b) any uncontrolled criticality excursion;

c) any explosion or fire likely to affect safety;

d) any occurrence during the transport of nuclear matter which is likely to cause death or injury from radioactivity, or the breaking open of a container of nuclear matter.

They are also required by licence conditions to report incidents involving exposure to radiation above prescribed limits and whenever inspection or testing reveals that the safe operation and conditions of the plant may be affected. My right hon. Friend the Secretary of State for Scotland and I have made arrangements with the Health and Safety Executive to be informed of such occurrences, and also to be told of certain occurrences of lesser significance. We propose to inform Parliament at once of any occurrence reported under the Dangerous Occurrences Regulations. More generally we have arranged for a quarterly statement to be published by the Health and Safety Executive, covering all the occurrences reported to us under the arrangements referred to. Besides numerical information, this statement would give short particulars and an assessment of any occurrences that were of significance for safety. Similar arrangements will be made for the reporting of occurrences on AEA sites. These will be covered in the quarterly statement."

10. **INCIDENTS TO BE REPORTED**

The statement describes the range of occurrences to be reported under the Dangerous Occurrences Regulations and gives an outline of the incidents to be reported under the conditions attached to nuclear site licences, but it has been necessary to define for the benefit of operators and to provide a uniform basis for day to day working the occurrences which would be reported under the category of lesser significance. The definition agreed for the reporting of minor occurrences is as follows:

"Abnormal occurrences leading to a release or spread of radioactivity outside a controlled area; or a similar occurrence inside a controlled area if in that event any special action or investigation by the operator is required".

Releases of radioactivity may arise in some degree (and be recorded) in ordinary working practice and under controlled conditions. The above definition is therefore related to deviation from the normal or expected. These incidents are unlikely to be of significance for safety since the reporting requirements for safety related occurrences under the Dangerous Occurrences Regulations and licence conditions cover such events, nevertheless they are of potential public interest and they will record.
deviations from normal working. The operator may also report any occurrence not falling within the above definition if he thought it desirable to do so because there were special reasons for thinking that it was going to attract publicity.

11. QUARTERLY STATEMENT ON INCIDENTS

The quarterly statement sets out the number of occurrences reported to the HSE under the arrangements described above and classifies them as appropriate giving short particulars and an assessment of any that were of significance for safety. The statement is published to the Press and copies are placed in the libraries of the two Houses of Parliament.

The first quarterly statement covered all incidents reported to the Secretary of State for Energy and the Secretary of State for Scotland in the period 9 December 1976 to 31 March 1977. Most of the 22 incidents reported involved small spillages or leakages of radioactivity which were quickly dealt with. Only 2 of the incidents required further action. 3 of the incidents recorded the presence of trace quantities of radioactivity on spent fuel element transport flasks in excess of the permitted operating levels but these incidents did not present any significant radiological hazard. No member of the public was involved in any of the incidents, and all radiation exposures of personnel were within permitted levels as recommended by the ICRP and endorsed in the UK by the MRC and the NRFB.

The second quarterly statement which was published on 31 August 1977 covered the period 1 April to 30 June 1977. Again the most frequently occurring type of incident involved small spillages or leakages of radioactivity which were quickly dealt with. In three cases, minor radioactive contamination was found on empty spent fuel element transport flasks. Four cases of small fires were reported. All were quickly extinguished, radioactive materials were not involved and plant safety was not affected. None of these various incidents presented any significant radiological hazard to anyone.

Two reports refer to recorded radiation exposure to workers exceeding the permitted levels as recommended by the International Commission on Radiological Protection and one other refers to a potential case of personal radiation exposure above these levels. These three cases, as well as some of the incidents involving minor spillages and leaks referred to above are being further investigated.

A copy of the second quarterly statement which gives details of the range of incidents reported is attached.

The requirement to publicise information on incidents at nuclear installations is illustrative of the action being taken in the UK to keep the public informed. Most of the incidents are trivial and so far there has been little reaction from the media or any other interested parties. The duty is to make prompt reports of minor incidents has not resulted in an undue burden on the licensees or the other nuclear operators but the publication of the quarterly statement sets the nuclear industry apart from all other industrial enterprises and the operators consider this very undesirable.
Once started a requirement to report and publish incidents at nuclear installations is difficult to abandon unless there is a radical change in the climate of opinion and it is unlikely that there will be a significant reduction in the reporting requirements in the near future. Nevertheless as experience is gained in operating the scheme it should be possible to introduce modifications which will make the quarterly statement by the HSE a more meaningful contribution to the public debate on the use of nuclear power.

12. CONCLUSIONS

There is a wide ranging public debate on the use of nuclear power in the UK. Energy policy and in particular the nuclear component is at present undergoing a critical examination by many different public and private organisations. There is an increasing demand for detailed information on the safety of the operation of nuclear installations and on the environmental consequences of adopting a large scale nuclear power programme as well as the security of fissile material. The action taken by the Government, Regulatory bodies and other organisations to make more information available on all aspects of the production of and demand for Energy and in particular the risks and benefits involved in the use of nuclear power should increase public understanding of the complex issues involved. This should provide a framework in which energy and nuclear policy decisions can be taken with full public acceptance.

FIGURE 1  INPUTS TO NUCLEAR POLICY MAKING

The diagram shows the range of interests and considerations which are taken into account in formulating nuclear energy policy.

Public Acceptability
Parliamentary Debate,
Parliamentary Select Committees,
Royal Commission on Environmental Pollution.

Expressions of public opinion through:
  a) Energy Conference
  b) Meetings with Ministers
  c) Correspondence with Ministers and MPs
  d) Local public opinion expressed at local liaison committees
  e) Planning enquiries

Economic Considerations
Estimates of energy resources and potential for energy conservation
Comparative costs
Projected energy demand
Generating Boards' power station requirements
Nuclear power capability:
Reactor and fuel technology, nuclear construction capability,
Industrial research

Safety Considerations
Radiological Protection Standards
International recommendations, (ICRP),
endorsed by NRFB and MRC in British Directive
Regulatory
  a) Occupational health
  b) Public health
  c) Nuclear site
  d) Protection of the environment
  e) Protection of the agriculture and fisheries
  f) Transport

Emergency Planning
International Obligations
UN (IAEA, WHO etc), OECD (NEA), EC

GOVERNMENT DEPARTMENTS
PARLIAMENT
NUCLEAR POLICY

Abbreviations:
EC Energy Commission;  IAEA International Atomic Energy Authority;
ICRP International Commission on Radiological Protection;
MRC Medical Research Council;  NEA Nuclear Energy Agency;
NRFB National Radiological Protection Board;
OECD Organisation for Economic Co-operation and Development;
UN United Nations;  WHO World Health Organisation
FIGURE 2
Distribution of Responsibility for Nuclear Health and Safety and the Protection of the Environment

ICRP: proposes basic standards of radiological protection

DESS  MRC  NRPB

conducts radiobiological research, endorses basic ICRP standards for UK

conducts applied radiobiological research, formulates codes of practice on radiological protection, gives advice to Departments, operators etc on radiological problems

Control Organisations

<table>
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<tr>
<th>BSE</th>
<th>DOE</th>
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<th>MAFF</th>
<th>DTP</th>
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Site licence

Control of discharges to the environment

Transport of radioactive materials

Operators of licensed sites

UKAEA

Health and Safety at Work Act

Abbreviations:
DESS Department of Health and Social Security
DOE Department of the Environment
DOT Department of Trade
DTP Department of Transport
BSE Health and Safety Executive
ICRP International Commission on Radiological Protection
MAFF Ministry of Agriculture, Fisheries and Food
NRC Medical Research Council
NRPB National Radiological Protection Board
SO Scottish Office
WO Welsh Office
QUARTERLY STATEMENT ON INCIDENTS AT NUCLEAR INSTALLATIONS
SECOND QUARTER 1977

The Health and Safety Executive presents the attached statement on incidents at nuclear installations reported under the arrangements announced to Parliament by the Secretary of State for Energy on 2 February 1977 (Hansard Cols. 209 and 210). All such incidents reported to the Secretary of State for Energy or the Secretary of State for Scotland in the period 1 April to 30 June 1977 are included in the statement.

The most frequently occurring type of incident involved small spillages or leakages of radioactivity which were quickly dealt with. In three cases, minor radioactive contamination was found on empty spent fuel element transport flasks. Four cases of small fires were reported. All were quickly extinguished, radioactive materials were not involved and plant safety was not affected. None of these various incidents presented any significant radiological hazard to anyone.

Two reports refer to recorded radiation exposure to workers exceeding the permitted levels as recommended by the International Commission on Radiological Protection and one other refers to a potential case of personal radiation exposure above these levels. These three cases, as well as some of the incidents involving minor spillages and leaks referred to above are being further investigated.

Details of the incidents including in one case a statement made to Parliament by the Secretary of State for Energy, are given below in chronological order together with the name of the nuclear establishment concerned.
Investigation by BNFL into the cause of the particulate activity found on a
grassed area at the Windscale licensed site on 27 March, and reported as
incident No 77/13 in the first quarterly report for 1977, has continued in
the second quarter. In April some particles were found on a public road and
in fields near the licensed site. The activity was low and did not constitute
a radiological hazard. The most likely source of the radioactivity is
considered to be a stack which provides the ventilation discharge for a number
of facilities on the site. Continuing monitoring for further deposition of
activity indicated none since that originally found. Requirements for closely
monitoring the individual discharges from each facility as well as the total
discharge from the stack are being implemented. Investigations are
continuing.

On 31 March the radiation film badge of a process worker at Windscale indicated
an increment which raised his exposure over a calendar quarter to slightly
above the permitted limit. The man was withdrawn from radiation work. An
initial report indicated that only a proportion of the recorded radiation dose
should be correctly attributed to the worker, and investigations to determine
this are continuing.

On 26 April a fuel element transport flask, empty except for some contaminated
water, had to be manoeuvred on a road transporter along a roadway on the
Bradwell site. Subsequent surveys revealed small areas of low level
contamination on the transporter and on the roadway over which the flask had
passed. A survey of the whole area established that there was no significant
radiological hazard and that no activity had spread from the road.

The contamination arose from a small spillage of water from the flask during
the manoeuvre. The transporter was decontaminated, the contamination on the
road removed and the road resurfaced.
On 26 April a plutonium-in-air monitor in a plant change room at Windscale went into alarm during the routine handling of contaminated clothing by a safety equipment worker. Checks made on the three workers who were present showed that they had received only a minimal uptake of plutonium and all have returned to normal duties.

During an experiment with plutonium compounds on 28 April in a sealed handling facility at a Windscale laboratory a chemical reaction caused a pressure rise sufficient to force off a plastic waste container attached to a port on the facility, thus releasing some plutonium activity into the laboratory. No one was inside at the time but a member of the staff wearing a respirator entered the laboratory to investigate and switch off services, and while doing so he received substantial external contamination. This was quickly removed. Checks made shortly afterwards, and subsequently, have indicated that the man’s radiation exposure and plutonium intake were insignificant and he has resumed normal duties. No one was injured.

BNFL have instituted an enquiry to decide what action should be taken to prevent a recurrence. Operations in the laboratory have been suspended pending the outcome of the inquiry and the completion of decontamination work.

This incident was reported to Parliament on 22 June by the Secretary of State for Energy in an answer to a Parliamentary Question.

A fuel element transport flask, returned empty to Winfrith on a rail truck, was received on the site on 29 April. A survey showed that contamination of the flask was within permitted limits, but when it was unloaded on 2 May contamination in excess of the permitted limits was found on small areas of a flask cradle transit frame and the bed of the truck. The contamination, which was quickly cleaned up was, on investigation, found to have been caused by a leakage of a small amount of contaminated water from a faulty valve on the flask. The fault has been rectified. The contamination was inaccessible during transit and no one was exposed to any significant radiological hazard.
On 10 May 1977 a chemical reaction involving about 2.5 kilograms of sodium in water occurred in a solid waste disposal facility at Dounreay. The energy produced by the reaction displaced the concrete covers on the facility but without causing significant damage. No one was in the area and no one was injured. A survey showed a few small spots of minor radioactive contamination. The waste consists mainly of discarded solid components, some of them slightly contaminated with sodium. Measures to prevent a recurrence are in hand.

On 13 May a grab failed to engage properly on a fuel element during a refuelling operation at Berkeley. The reactor was shut down to deal with the problem and operation was resumed on 15 May. There was no danger to personnel or damage to the plant.

On 15 May a process worker became slightly contaminated while handling equipment returned from the decontamination centre at Windscale. Initial checks indicated contamination above the permitted levels but more comprehensive investigations later gave negative results. The man has returned to normal duties.

On 17 May during the annual shutdown of No 1 reactor at Trawsfynydd for annual inspection the roof was being repaired by contractors. A small heap of bitumastic material on the roof caught fire during a meal break. The fire was quickly extinguished by station staff. However, as required under the standard procedure, the local fire brigade was alerted immediately and fire-fighting vehicles arrived on site soon afterwards. No one was injured and the damage to the roof was minor.

On 17 May a health physics monitoring survey was being carried out preparatory to the erection of scaffolding on an external wall of the building containing
the pond effluent settling tanks at Windscale. An area of about two square feet of soil was found to be slightly contaminated. No significant radiological hazard was caused but the area was fenced off to prevent access and an investigation is proceeding.

77/2/12 WINDSSCALE WORKS BRITISH NUCLEAR FUELS LIMITED

On 22 May a routine health physics survey detected some slight radioactivity on a BNFL inactive waste tip at Windscale. The activity, confined to an area of 15 by 20 yards, has been removed, and no one was contaminated. The waste tip is fenced and has a controlled access for tipping. An investigation is proceeding to determine the source of the contamination of the tip.

77/2/13 WINDSSCALE WORKS BRITISH NUCLEAR FUELS LIMITED

On 27 May the radiation film badge of a worker employed by a contractor at Windscale indicated an exposure of 12 times the annual permitted level. An initial report indicated that no more than a small proportion of the recorded radiation should correctly be attributed to the worker and investigations to determine this are continuing.

77/2/14 WINFRITH - UKAEA

On 3 June, during the routine monitoring at Winfrith of an empty flask returned from BNFL Windscale on a rail truck, contamination slightly above the permitted operating level was found on the surface of the flask. Similar low level contamination was found on the truck after the removal of the flask. There was no significant radiological hazard. The flask and the truck have both been decontaminated and returned to service.

77/2/15 WINDSSCALE ADVANCED GAS COOLED REACTOR - UKAEA

On 12 June monitoring instruments indicated traces of radioactive gas in the pile cap operating area of the Windscale AGR. The staff were evacuated from the containment area. At the same time the fuel failure detection equipment indicated a failed fuel element in the reactor core and the element was discharged during the night of 12/13 June. Analysis on the 13 June showed that the gas was xenon 133, which is normal emission from a defective fuel element. Operation was continued using self-air sets until 14 June when normal working
was resumed. There was no significant radiological hazard.

77/2/16 WINDSCELL WORKS BRITISH NUCLEAR FUELS LIMITED

On 14 June, during a routine survey for contamination of protective clothing left in a change room at Windscale, a shift worker's coverall was found to be contaminated on one sleeve. The skin dose which he might have received has been estimated, at a maximum, to be 3 times the annual permitted dose and the incident is being further investigated. The man has been withdrawn from active area working pending the result.

77/2/17 WINFRITH UKAEA

At Winfrith on 20 June, during the extraction of radioactive cobalt metal sources from their stainless steel container, airborne contamination was detected by monitoring instruments. Five operators, who were working with manipulators through a shielding wall, immediately withdrew. On subsequent investigation, four of them were found to have received contamination above the permitted level in their hair and on their protective clothing. The contamination was removed by washing and further checks indicated that the intake of radioactivity was well below the permitted levels. Measures have been taken to prevent a recurrence.

77/2/18 WINDSCELL WORKS BRITISH NUCLEAR FUELS LIMITED

During the handling of low level plutonium waste packs in a process building at Windscale on 22 June the plutonium-in-air monitoring alarms sounded. Two of the four workers involved had high readings on their personal air samplers, but further checks were made on all four and they were withdrawn from active area working pending the results. Additional checks on the worker with the highest reading showed that he had inhaled much less than the permitted level of plutonium. Low level contamination was found on one waste pack. The area was decontaminated and a formal investigation is being held.

77/2/19 TRAWSFNYDD NUCLEAR POWER STATION CENTRAL ELECTRICITY GENERATING BOARD

On 27 June two small lagging fires occurred at Trawsfynydd on a turbogenerator which had been shut down for annual overhaul. The fires were extinguished by station staff and the location later inspected by the local fire brigades. There was no radiological hazard and no one was injured.
77/2/20  HINKLEY POINT NUCLEAR POWER STATION CENTRAL ELECTRICITY GENERATING BOARD

On 29 June a pipe supplying cooling water to a "B" station reactor pressure vessel and gas circulators fractured. The operators shut down the reactor and provided an alternative cooling water supply. The safety shutdown systems operated correctly, cooling gas circulation in the reactor was maintained and the reactor fuel temperature rise was insignificant.

The incident caused flooding to a part of the main circuit water pump house and loss of cooling water to the main turbine. There were no nuclear safety effects, no release of radioactivity and no injury to personnel.

77/2/21  TRAWSFYNYDD NUCLEAR POWER STATION CENTRAL ELECTRICITY GENERATING BOARD

On 29 June minor radioactive contamination was found on a mobile crane being used by a contractor in the switchgear compound adjoining the Trawsfynydd nuclear power station licensed site. The crane had arrived from Windscale the previous day.

Checks showed that the driver had received no contamination and the vehicle was decontaminated for use the following day. Investigations into the source of contamination of the crane are proceeding.

77/2/22  WYLFA NUCLEAR POWER STATION CENTRAL ELECTRICITY GENERATING BOARD

On 30 June a small fire occurred in No 2 building at Wylfa where construction work was in progress. The location was construction jointing in the floor and between the walls and the fire involved a short length of the fireboard joint in the floor and in the external wall. The local fire authority was called as is required and they extinguished the fire in about 15 minutes. The evidence suggests that the fire may have been started by a spark from contractor's work on ventilation ducting nearby.

There was no radiological hazard and no one was injured.

77/2/23  DUNGENESS NUCLEAR POWER STATION CENTRAL ELECTRICITY GENERATING BOARD

On 30 June smoke was seen coming from one of the turbogenerators at Dungeness "A" station. The generator was shut down and the local fire authority was informed as required. The fire brigade arrived and stood by while the station staff dealt with the fire. There was no radiological hazard and no one was injured.
The public information aspects of the regulation of nuclear power present a unique set of problems. Not only must the regulators communicate often complex technical information to the public, they must also assure the public, the press and the legislative bodies of the adequacy of the regulatory process and the safety of power plant operations. The United States Nuclear Regulatory Commission (NRC), recognizing the importance of a continuing, open dialogue with the public, has placed particular emphasis on informing the public of its operations. NRC's experiences have been both good and bad. On balance, however, the NRC believes it is following the best course by conducting its operations openly and candidly.
Introduction

I am certain that those of us privileged to represent our respective countries at this meeting would agree that the principal objective of any nuclear inspection program is the protection of public health and safety. And we would, no doubt, concur in the importance of assuring the public that our inspection programs are an effective part of the regulatory program which protects them. It is not enough to have a technically competent inspection organization. The political leadership, the press, and the public also must be convinced of that technical competence. That point is underscored by the foresight of the Commission on the Safety of Nuclear Installations in planning this discussion of the public information aspects of nuclear inspection. This is a most timely topic that, unfortunately, is too seldom emphasized. I appreciate the opportunity to participate and I hope that these remarks concerning our information practices and experiences in the U.S. will prove helpful.

For most of us in the inspection field, the public information role is frequently unfamiliar and occasionally uncomfortable. It is uncomfortable because the nuclear regulator would generally prefer to address technical issues to technical people on a technical level. But we have a responsibility to address technical issues to nontechnical people on a nontechnical level. This is much more difficult, but it is becoming increasingly important because of the growth of nuclear power worldwide and the attendant increase in public scrutiny.

Public understanding of the technical issues, as well as the social and political issues, is essential to winning the public's confidence in the effectiveness of nuclear regulation and, ultimately, in the safety of nuclear power. Without that public confidence, nations may be forced to abandon nuclear power as a source of energy. And for many nations, the United States included, that is not a viable alternative.

I do not believe it is an overstatement to say that nowhere is that public confidence more important than in the area of reactor inspection. In the U.S., we are seeing more and more attention focused on the inspection program, particularly the work of individual inspectors at individual nuclear facilities. Political leaders, the press and the public look to the inspector as their final line of defense against the hazards--real or perceived--of nuclear power. It is undoubtedly true that relatively few people in any country know what a reactor inspector does or how he fits into the overall scheme of nuclear safety. From our own experience, I would say that the inspection program gets very little credit for safety but takes a good share of the blame when things go wrong. Nonetheless, the public needs assurance that a competent, professional, independent inspector is on the job. Giving the public assurance can be a major factor in improving the public's overall attitude toward nuclear power.

I would like to review for you how the Nuclear Regulatory Commission's Office of Inspection and Enforcement approaches its public information responsibilities, and recount some of the experiences we have had--both good and bad--in this area since we were established as an agency two and one half years ago.
NRC Information Philosophy

The NRC's basic philosophy about public information was initially expressed by William A. Anders, the first chairman of the NRC, in an appearance before our Congress. "Nuclear regulation," he said, "is the public's business and it must be transacted publicly and with candor. The public must be informed about and participate in the regulatory process to the fullest extent permitted under law." I sincerely believe that the philosophy and practice of openness and candor in dealing with the Congress, the press and the public has wide acceptance throughout the agency. In that spirit of candor, I admit that our reasons have not been entirely altruistic but, in some cases, are very practical. Let me explain.

One of the principal criticisms of the old Atomic Energy Commission was that it was an overly secretive agency that was not always candid with the American people about the hazards of nuclear energy. When the NRC was created in 1975 to take over the regulatory functions of the AEC, it received a new Commission and also experienced a significant turnover in its top management. In many respects, it was a new agency. One of the results was a real determination on the part of the NRC to divorce itself as quickly as possible from the secretive image of the old AEC. And we have done this by trying to be as open with the public as possible.

The general trend toward greater openness in all parts of the government and the Freedom of Information Act, under which most government documents may be obtained by the public and the press, have both contributed to our increased openness. We have taken the realistic position that it is preferable to voluntarily release information rather than wait for it to be leaked to the press or pried out of the agency under the Freedom of Information Act.

There are other good reasons for being open and candid, not the least of which is that it is good public policy for us to let our citizens know what their government is doing on their behalf. I think this philosophy is helping the agency as well as the public. For example, I am certain that public scrutiny causes us to be more thorough and accurate in our inspections and to evaluate and document more carefully our technical positions.

I mentioned earlier the necessity of building confidence in the effectiveness of nuclear regulation. Two public opinion polls conducted in the U.S. recently have shown that of all the individuals and organizations who talk about nuclear power, the overall credibility of the NRC and its level of public confidence is exceeded only by the general category of "scientists." We take a considerable amount of satisfaction from these results.

Regarding public opinion in the U.S., it is well to keep in mind that nuclear power generally has the support of the American people by a wide margin. Most public opinion polls show a consistent trend favoring nuclear power by about a two-to-one margin. Last year, several of the states conducted referenda concerning the future use of nuclear power. The results of these elections followed the same pattern of two-to-one support for nuclear power. These state elections, however, have not ended the controversy. If anything, it has been intensified, recently in the form of the large demonstrations and sit-ins familiar to many other countries.
Fortunately for the NRC, our charter from the Congress as an independent Federal regulatory agency has permitted us—in some instances, even required us—to avoid many of the verbal confrontations between those supporting and opposing nuclear power. The principal reason for the Congressional decision to abolish the AEC was to separate the regulatory functions from those involved in promoting the use of nuclear energy. Officially, we take no position in the social and cultural debate over whether or not nuclear power is a good thing. Our responsibility, as defined by the Congress, is to assure that if nuclear power is used, the public health and safety and the environment will be protected. As a result, we concentrate on our own technical evaluations of the safety of specific projects. It is on this level that the NRC Office of Inspection and Enforcement assumes public information responsibilities.

NRC Organization

The Office of Inspection and Enforcement consists of a headquarters and five regional offices. All of our inspectors are located in the regional offices.

Because of the concentration of our work in the Regional offices and the growing public visibility of the inspection program, the NRC Office of Public Affairs, which reports directly to the five-member Commission, has assigned a Public Affairs Officer to each of our Regional offices. The Office of Public Affairs has the principal responsibility for the dissemination of information to the public and the news media. The Regional Public Affairs Officers work closely with our field Inspection and Enforcement staff on the release of information concerning inspections, investigations and safety-related incidents at nuclear facilities. We consider it particularly important that the regional Inspection and Enforcement staff keep the Public Affairs Officer fully informed on all matters of potential public interest, and that the Public Affairs Officer have access to all letters, reports and other documents that are available to the public.

We also consider it important to make our inspectors and management accessible to the press and the public for responding to inquiries of a technical nature. As a result, the Public Affairs Officers frequently call upon individual inspectors or other regional or headquarters personnel for assistance in responding to questions. Many of our inspectors also are available for speeches to local civic and educational groups.

Communicating With The Public

The actual dissemination of information to the public is accomplished in many different ways, depending on the nature of the data and the degree of potential public interest. For major announcements of national interest, we normally hold briefings and press conferences at the NRC headquarters in Washington in connection with the actual release of the information. Items of principally local interest are released through the regional offices, either as written press releases or direct telephone calls to the news media.
For strictly routine information, the NRC maintains about 200 Local Public Document Rooms around the country, most of them located in public libraries near existing or proposed nuclear power plant sites. Each Local Public Document Room receives copies of all reports, correspondence and other documents pertaining to the local nuclear facility, including copies of all inspection reports. In addition, they keep copies of reports of high public interest dealing with all nuclear facilities. A summary of all occurrences reported by licensed nuclear facilities is also made available. We believe that this type of material, available on a routine basis in a convenient public place, provides the local citizens with access to a wide range of information concerning both the local project and the larger national issues.

Naturally, the more difficult information problems arise over accidents, malfunctions and other incidents at operating reactors. While it is hard to generalize because no two problems are ever the same, I can give you an outline of how the Office of Inspection and Enforcement and the Office of Public Affairs respond with information concerning events having potential safety significance at reactors.

Each license issued by the NRC contains requirements for reporting various events to the NRC, usually through the nearest Regional office. When such reports are received, we normally dispatch an inspector to the site, if the situation warrants, for first-hand observation and evaluation. In this regard, one of the major advantages of our new resident inspection program will be having our own on-site source of immediate information.

One of the first decisions we make after receiving such reports is whether or not to issue an announcement to the news media. Obviously, it is neither practical nor desirable to issue an announcement on each and every reportable occurrence at all reactors, the majority of which are minor or even trivial events of no direct safety significance to the public.

This decision is not always an easy one to make. At what point and under what circumstances does an incident take on sufficient importance to warrant an immediate news release? Should we announce any release of radioactivity, however small and insignificant to the public health? Would we be unnecessarily arousing public apprehension or would we, in fact, be serving the public interest by reassuring the public that there is no health hazard? Another difficult problem lies with the release of information that has not been fully investigated and evaluated by our inspectors. Could we inadvertently mislead the public with information that further investigation shows to be not true?

To assist our Inspection and Public Affairs personnel in making these often difficult decisions, we have developed a set of criteria identifying those situations where we believe press announcements are warranted. While the criteria we use are not perfect and do not solve all the problems, they provide guidance to the Regional staff to make their own evaluations on the advisability and necessity of issuing announcements.

We also actively encourage our licensee companies to issue their own statements concerning incidents at their facilities. Under our regulatory philosophy, the licensee has the primary responsibility for the safe operation
of his plant. Consequently, we prefer that the initial notification to the press concerning incidents come from the licensee, who is usually in the best position to evaluate the situation and explain its significance. We have provided our licensee with copies of our press release criteria, stressing our hope that they would make their own announcements before we do.

Most licensees agree with our philosophy and have made good-faith attempts to keep the press and the public informed on significant events at their facilities. At least one company issues a routine daily report on the status of its nuclear facility. Others issue weekly operating summaries. Generally, the companies prefer to notify the press themselves rather than to have the information come from the NRC. But whether or not the licensee chooses to issue its own announcement, our procedures assure that the public is notified of what we consider to be significant or potentially significant events. This, I believe, goes a long way in building public confidence in our inspection program.

Another situation that develops occasionally involves requests, usually from the news media, to accompany one of our inspectors during an inspection. We do not actively seek out these situations but we have tried to accommodate them, short of accompanying an inspector during an actual inspection. Generally, we let a reporter accompany our inspector on a tour of the plant after the normal inspection is completed and explain how the inspector does his job. The television and newspaper reports as a result of these interviews generally have been very complimentary, both to the individual inspector and the program.

Information Case Studies

I wish I could report to you that, because of our desire to be open and candid, all of our public information experiences in the inspection area have been favorable. Such is not the case. We have had some problems in dealing with the news media. Our overall experience tells me, however, that the more information we make immediately available to the press, the more objective and balanced the reporting and public reaction to it. And that is our ultimate objective. When we have released all the information available, at one time, in a context that was meaningful, and readily responded to questions, the press reaction has been quite good. Where we have had difficulties is when we either did not or could not get the information to the media in a timely manner.

One such occasion took place early this year. A nuclear power plant inadvertently released a small quantity of radioactive material into a river upstream from a small city. Based on the information available at the time, our Regional personnel believed that the small quantity did not warrant a public announcement. The radioactivity was detected in the river and the nuclear plant identified as the source. This led to charges of a "cover-up" and an unpleasant confrontation with the citizens of the city. Had we issued a press release at the time, I imagine that the episode would have passed from public attention in a day or two. As things turned out, we were still hearing angry citizen complaints a month later.

Another unhappy experience involved a fire at the Browns Ferry plant in 1975. In this case, we made a concerted effort to notify the news media. But our Public Affairs Officer encountered a strange thing. The press was not
particularly interested at the outset. The fire occurred on a Saturday afternoon when the newsrooms were sparsely manned. The initial media reaction to both NRC and licensee calls was that a construction fire had occurred, it was put out and no one was injured. End of story. In fact, some wire service and newspaper reporters actually declined our offer to provide additional details. It was two or three days before the more experienced reporters began to grasp the significance of the fire and seek more information.

Later we received a good share of criticism from the media and some anti-nuclear groups for the prolonged period, nearly four months, that it took us to complete and release our investigation report. I am certain that those of you in this audience understand the time requirements and difficulty in preparing a technically factual report on a complex situation like the Browns Ferry fire. But some members of the news media did not understand. Obviously, we wanted to issue one comprehensive report rather than a series of statements that might have to be changed or corrected at a later date. This was an entirely responsible course of action, but it did lead to charges that the NRC was trying to cover-up the seriousness of the fire.

Another occasion when we chose not to issue a public announcement involved a so-called security alert at all U.S. reactors last year. We had received some fragmented information, none of it confirmed, of possible threats against different nuclear plants during a major U.S. holiday weekend. Although apparently unrelated, the number of reports caused us some concern and led us to ask each of our licensees to be particularly vigilant that weekend. We did not order increases in guard forces nor ask them to take any special precautions.

Because of the unsubstantiated nature of our information and the fact that we were not taking any special action, we decided against making a public announcement. In retrospect, that probably was the wrong decision. When we notified our licensees, they, in turn, alerted their local law enforcement agencies, and soon the news wires were buzzing with stories about a nationwide terrorist alert at all nuclear facilities. Being a holiday weekend with little of the normal news flow, the story got far more attention than it deserved. Our Public Affairs staff spent more of the weekend on the telephones trying to put the story in its proper perspective, while I and others spent several weeks trying to explain it to the Congress.

The cases I have recounted, however, were some of the exceptions to a generally positive experience we have had in the information field. Two of our more successful experiences dealt with particularly sensitive subjects, which, if not handled properly, could easily have been sensationalized and distorted by the media, unnecessarily frightening the public.

The first involved a hospital where almost 400 patients over several months received radiation therapy doses significantly in excess of the prescribed doses. Several patients died as a result of the overexposures. When the overexposures were discovered, the hospital notified the NRC and the patients' doctors. Both the hospital and the NRC subsequently held a series of press briefings as the story unfolded, and the result was generally balanced and objective coverage. One of our concerns was the need to avoid frightening prospective teletherapy patients to the extent that they might refuse needed radiation treatment. We believe we succeeded in this area.
The other incident involved an investigation into reports that workers at a commercial, low-level radioactive waste burial facility had been illegally scavenging items such as contaminated tools and lumber from the waste and using them in the nearby town. The investigation included a house-to-house search, resulting in the recovery of thousands of items that had been taken from the waste burial facility. Here, as in the hospital case, we cooperated with state officials in issuing press announcements, responding to telephone inquiries and conducting a press briefing when the investigation was concluded. Again, the news coverage was well balanced and objective. The news media, I believe, came away with the feeling that a difficult problem had been successfully dealt with by the state and Federal nuclear regulatory systems. We could not have asked for more than that.

Conclusion

Those of us in the technical fields like to be able to predict and reproduce scientific results. This is rarely possible, however, when we enter the field of public information. Each situation is unique and the public information program must be tailored accordingly.

There are some hopeful signs for the future, however. In the past two years, the subject of nuclear power has been brought to the attention of the U.S. public as never before. I am convinced that the U.S. news media learned more about nuclear power—its truths and myths—during the state referenda campaigns last year than they had from the combined efforts of the industry and government information programs since the beginning of the nuclear age.

The many statements made on nuclear power have forced the press and the public to look seriously at the issues and institutions involved, including our reactor inspection program. I welcome that public examination, and I am determined to see that the NRC inspection program responds to the public's right to know.

I hope this discussion has been useful. Though I recognize that the information demands and techniques of each nation and each situation differ, we are all in the same business—trying to conduct inspection programs that will protect the health and safety of our respective publics. I welcome the opportunity to discuss with any of you the substantive aspects of nuclear inspection and new ideas for convey to the public the story of how a government regulates a complex technology.
INSPECTION OF NUCLEAR FUEL TRANSPORT IN SPAIN

J. Lobo Méndez
Junta de Energía Nuclear

La experiencia adquirida en la inspección de los transportes de combustibles realizados en España, servirá de base para fijar las normas que han de exigirse a los futuros transportes, ya que debido al programa nuclear español el transporte de combustibles nucleares se verá incrementado notablemente en España en los próximos años. Se pretende con esta comunicación poner de manifiesto la experiencia adquirida por la inspección oficial en el transporte de combustibles nucleares.

The experience acquired in inspecting nuclear fuel shipments carried out in Spain will serve as a basis for establishing the regulations which must be adhered to for future transports, as the transport of nuclear fuels in Spain will increase considerably within the next years as a result of the Spanish nuclear program. The purpose of this report is to describe the experience acquired in nuclear fuel transport inspection.
1. **INTRODUCTION**

The transport of nuclear fuels plays an important role in a nuclear power plant's operation and even in its performance, if the established transport program is altered.

The experience acquired in inspecting nuclear fuel shipments carried out in Spain will serve as a basis for establishing the regulations which must be adhered to for future transports, as the transport of nuclear fuels in Spain will increase considerably within the next years as a result of the Spanish nuclear program. We have experience in transporting non-irradiated fuel by plane, ship and highway and in transporting irradiated fuel by road, train and ship.

Figure 1 indicates the most frequently used itineraries for transporting nuclear fuels in Spain. In the "José Cabrera" plant, the non-irradiated fuel arrives by plane to Barajas Airport and continues by road to the plant; the irradiated fuel is shipped by road from the plant to the Port of Bilbao and from there by ship to the United Kingdom. In the "Santa María de Garoña" plant, the non-irradiated fuel arrives by ship to Bilbao and continues by road to the plant; the irradiated fuel is shipped by road to the Dancharinea Customs and from there continues by road through France and is finally shipped to the United Kingdom. In the "Vandellos" plant, the non-irradiated fuel arrives by road to La Junquera Customs and continues by road to the plant; the irradiated fuel is sent by train from the plant to the Port Bou Customs and continues by train until reaching its final destination in France.

The purpose of this report is to describe the experience acquired in nuclear fuel transport inspection and for a better understanding, we have divided the study into the following sections:

Identification of the risks in transporting nuclear fuels.

Steps to avoid or reduce risks: Regulations applicable in Spain.

Requirements prior to shipment.

Experience in transporting nuclear fuels in Spain.

Inspectors' role in nuclear fuel transport.

Conclusions.
2. IDENTIFICATION OF THE RISKS IN TRANSPORTING NUCLEAR FUELS

The characteristic risks in transporting nuclear fuel are irradiation, contamination and criticality, and in all the national and international Regulations, rules for avoiding or reducing these risks are given. However, depending on the means of transportation and the itinerary followed, other risks may exist, such as: conventional accidents, sabotage, terrorism and theft.

In railway transport carried out in Spain from the Vandellós nuclear power plant to the reprocessing installations in La Hague, France, due to the light weight of the train, there is a risk of accident due to sharp breaking or when traveling on an incline as the cars can bang into each other and cause derailment.

In road transport of irradiated fuel, there is an additional risk of irradiation if the transports are not well-planned. This risk exists in storage on the pier until the packages are transferred to the ship or during storage required until the packages are dispatched through the Dancharinea Customs in the case of the Santa María de Garoña plant.

There is a danger of accidents in transports of irradiated fuel made from the José Cabrera plant while traveling through the Barazar mountain pass and from Santa María de Garoña through the Velate mountain pass, due to the road's sharp incline and its limited width. In addition to the accidents we must add skidding in winter - as these areas are covered with ice and snow - and also terrorism and sabotage as during the last few years the Basque Provinces have been politically conflictive areas and terrorist acts have taken place there.

We have observed, especially in the transports made from the José Cabrera plant, exudation phenomena, which in no case surpassed the regulatory limits for transitory surface contamination.

3. METHODS FOR AVOIDING OR REDUCING RISKS: REGULATIONS APPLICABLE IN SPAIN

The steps taken to avoid or reduce irradiation, contamination and criticality risks have basically consisted of applying the transport rules established in the Regulations applicable in Spain which are as follows:


- European Agreement on international transport of dangerous merchandise by road (ADR).

- International Rules for transporting dangerous merchandise by rail (RID).

- National Rules for transporting dangerous merchandise by road.

To avoid the risk of accidents, speed limits are placed on the expeditions and in the case of railway transport, sharp braking and take-offs are prohibited and a heavy-weight car is placed at the end of the convoy to assist in braking.

If shipments are made by road in the winter, before authorizing the expedition to leave, we check the snow and road conditions along the route by calling the Public Works Offices in the Provinces through which the convoy will pass.

A series of places are established along the route, from where telephone calls are to be made to the Inspection of the JEN informing of the convoy's progress. The places chosen have automatic telephone service.

Radio-protection personnel from the nuclear power plant in question always accompany the shipment with markers, detection equipment, etc. and they are perfectly aware of the rules to follow in case of emergency.

In the cab of each vehicle, and in a place visible from the outside, emergency telephone numbers are given which include the Nuclear Power Plant in question, the Nuclear Energy Board (JEN) and the Police or other Provincial Authorities. All the expeditions are accompanied by armed guards located at the front and back of the convoy.

4. REQUIREMENTS PRIOR TO SHIPMENT

The documentation presented for requesting transport authorization is studied by the JEN which issues a report on the transport's
nuclear safety and proposes conditions for carrying out same. The Nuclear Energy Board sends these studies to the Energy Administration Board which in turn authorizes transport based on these recommendations. This complete documentation is sent to the inspection which thus is informed of all the technical characteristics of the shipment to be effected. Figure 2 shows a diagram of the steps taken in processing a request for transport authorization.

In addition and in fulfillment of the clauses stated in the Authorization, the plants must send to the inspection a series of details, which includes: number and identification of the elements to be transported, degree of burn-up, number of cooling days, U-235 content, Pu-239 content, license number of the vehicles making the transport, packing identification, itinerary and schedule which has been established. If any abnormality or deficiency is found in the information received, the plant owner is contacted so that they may correct same or delay the shipment until the necessary corrections can be made.

5. EXPERIENCE IN TRANSPORTING NUCLEAR FUELS IN SPAIN

Below is a chart listing the total number of expeditions carried out by the three plants currently existing in Spain and the number of elements transported in each shipment (until July 1977).

<table>
<thead>
<tr>
<th>Nuclear Plants</th>
<th>Non-irradiated fuel</th>
<th>Irradiated fuel</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vandelllos</td>
<td>51</td>
<td>91,920</td>
</tr>
<tr>
<td>Sta.M. de Garoña</td>
<td>14</td>
<td>868</td>
</tr>
<tr>
<td>José Cabrera</td>
<td>12</td>
<td>205</td>
</tr>
</tbody>
</table>

6. INSPECTORS' ROLE IN TRANSPORTS

In the case of irradiated fuel, shipments are inspected before they are transported and in the case of non-irradiated fuels, they are inspected upon arrival into the national territory or upon arrival at the Plant.
In order to facilitate inspection, a Guide to systematic checking has been prepared which includes the applicable paragraphs of the I.A.E.A. Regulations for transporting radioactive materials without risks (1973 edition) and of the European Agreement on international road transport of dangerous merchandise (ADR). This Guide is divided into the following sections: 1. Documents which must be shown; 2. Marking and labeling of the packages and the vehicles; 3. Other package checks; 4. Radiation and radioactive contamination levels; 5. Other expedition checks. (Annex I).

Once these checks have been carried out, the Inspector issues a report which is signed by an authorized plant representative, indicating the latter's agreement or disagreement to its contents. Annex II presents a guide to issue the report.

While the transport is being effected, the Nuclear Energy Board (JEN) receives the telephone calls made from pre-established points along the route.

In the inspections carried out, no serious safety risks have been detected and the radiation levels as well as the transitory radioactive contamination readings have always been within the limits established by law. However, in some transports, we have observed the lack of documents required in the authorization conditions, incorrect labeling of packages and vehicles, lack of sealed bands on the packages and in some cases the vehicles did not carry the telephone number to call in case of emergency and in others the Nuclear Energy Board was not notified sufficiently in advance, as stated in the authorization conditions.

We have also observed that some packages were not marked in accordance with the markings established in the I.A.E.A. Regulations for transporting radioactive materials without risk (1973 Edition) and that the sender's certificate and shipping details did not comply with that specified in said Regulations.

It has been proven, in general, that the personnel handling the radioactive material in ports and airports are not prepared for this job and that the drivers of the vehicles also lack proper training. In several cases, the inspectors have observed that the drivers had not read the information which had been given to them several hours before starting the journey. Also, in some cases, vehicles which are not suitable for this type of transport and vehicles not authorized by the Spanish Authorities have been used.
7. CONCLUSIONS

1. In order to avoid risks during transport, no expeditions should take place during the winter season, if the route goes through mountain passes and when the weather conditions hinder or prevent normal travel along these roads.

2. Also, transport should be prohibited in areas where possible disturbances or alteration of public order could occur. In addition, a strict adherence to the schedule along the route should be demanded in order to avoid prolonged waits of the convoys at points along the itinerary or at shipping docks or at Customs Houses.

3. Speed limits should be more strictly enforced in order to avoid accidents and motorways or highways where there is a lot of traffic should be avoided as there is always a danger of accidents which could force the convoy to stop and wait for a certain length of time.

4. The personnel handling the radioactive material in ports and airports must have a clear idea about the care that is necessary to avoid falls and hits.
FIG. 1.—DRAWING OF THE FUEL ELEMENT TRANSPORTS FOR THE SPANISH NUCLEAR POWER PLANTS.
FIG. 2—PROCESS FOR ISSUING RADIOACTIVE MATERIAL TRANSPORT AUTHORIZATION.
TRANSPORT OF:______________________________________________
Origin: ____________________________________________________
Destination: ________________________________________________
Starting date: ___________________________________________________________________
Inspection location: __________________________ Date: __________

1. DOCUMENTS TO BE EXHIBITED

Transport Authorization, Ministry of Industry, date ______________________
Transport Authorization, Ministry of Public Works ______________________
Transfer Authorization (O.I.E.A. Safeguards) ____________________________

Sender's certificate and expedition details (827 to 831) (photocopy attached)________________________
Information for transport company (832) ______________________________________________________
Certificate of approval of type of package (804 - 824) _____________________________________________
Certificate of multilateral approval of type of package B (M) (807-824) ______________________________
Others ______________________________________________________________________________________

2. MARKING AND LABELING OF PACKAGES AND VEHICLES

2.1. PACKAGES

Labels affixed on two opposite sides of the package (511) _________________________________
Package category (510) __________________________
Main radioactive content __________________________
Content's activity (curie) __________________________
Transport index (137) ____________________________
If this refers to "complete charge", this will be mentioned on each label (513)_____________________

Weight marked on the package (514) ________________________________________________________
Identification marks of package type (515) _____________________________________________________
Type B package, cloverleaf symbol printed on outer surface (517) ________________________________

2.2. VEHICLES

- Truck: license number and platform number _________________________________________________
- Transport card number __________________________________________________________________
- Cars have signs on the sides (533) _________________________________________________________
- Trucks have signs on the sides and rear (535) (42.500 A.D.R.) _______________________________
Trucks carry emergency telephone numbers in visible place
Trucks and trailers are equipped with fire extinguisher (10.240 ADR)
Trucks have a battery switch in the cab (220.000 ADR)
Others

3. OTHER PACKAGE CHECKS

No visible damage
The sealed bands are intact (211)
The inscription on the sealed bands states:
The temperature will not exceed 50°C in the shade (231, b)
In case of a complete charge, the temperature will not exceed 52°C in the shade (240)
The outer packing will not absorb nor retain rainwater (206)
Others

4. RADIATION AND RADIOACTIVE CONTAMINATION LEVELS

Maximum admissible radiation intensity (534 and 537)
- In a closed vehicle, without package movement, without intermediate loading and unloading operations, on the package surface < 1,000 mrem/h.

- In any other type of circumstances, on package surface < 200 mrem/h.

- On outer side surface of vehicle < 200 mrem/h.

- At 2 meters distance from the vehicle's side surface < 10 mrem/h.

- In places occupied by people < 2 mrem/h (537).

Transitory radioactive contamination (frotis of 300 cm2) (502)
- Beta and gamma emitters < 10^{-4}(Ci/cm^2
- Natural uranium < 10^{-3}(Ci/cm^2
- Alpha emitters < 10^{-5}(Ci/cm^2

The drivers carry a dosemeter
Others

5. OTHER EXPEDITION CHECKS

The armed guard protection is formed by
The person traveling with the expedition in his capacity as radio-protection expert is Mr.
Time of expedition departure
Transport has been notified with days advance notice.
Other requisites contained in the authorizations
Mr. ____________________________, Inspector of the Nuclear Energy Board

CERTIFICATES: That he was present (1) on the day, month and year (all in writing) in (2).

That the object of the visit was to inspect a radioactive material shipment, destined for _______________, coming from _______________, whose transport authorization was granted by the Energy Administration Board on the date _______________ to (3).

That the Inspection Department was received by Mr. (4) ____________ who confirmed his knowledge and acceptance of the inspection objectives in that which refers to nuclear safety and radiological protection.

That the results of the tests carried out by the Inspector, as well as the information required and supplied by the technical personnel ________ are as follows:

That the shipment consisted of ______ packages, on whose identity plate was the following ________________.

That inside said packages, (5) was found stored, whose characteristics are indicated in Annex I:

That (if applicable) during transport no (or a) nuclear accident occurred; however the following facts or accidents did occur: (describe with greatest exactness what has happened).

That the sender's certificate was shown, duly authorized, photocopy of which is attached as Annex II (6).

That specification ____________ of the Energy Administration Board corresponding to this transport has not been complied with (if applicable).

That the packages were located on ________ frames, trailers, special cars, distributed in the following manner: package ________, frame, trailer, car __________, trailer truck license number ____________. That the trailer truck license number ____________ is not listed in the authorization granted by the Surface Transport Department of the Ministry of Public Works, as a vehicle authorized for this type of transport (if applicable).
That each package's sealed band is intact, with the following inscription (or without) (?). That the packages did not show any visible signs of outer damage (or they showed damage). That the packages were duly marked with labels corresponding to yellow category ________, on which I read: package ________: (transcribe literally, do not translate).

That the vehicles, cars, ________ were duly marked. That in the vehicle cab, a list of emergency telephone numbers were visible from the outside. That the drivers were equipped with a personal dosimeter, type ________.

That the transitory external contamination readings, as well as the radiation intensity and temperatures, measured by technical personnel from ________ in different parts of the packages ________ are not appreciable, the maximum admissible dose can increase under normal transport conditions.

That a radio-protection expert from the Plant accompanied the expedition, with the necessary equipment to act in case of emergency.

That the transport convoy left at ________ hours from ________, protected by armed guards.

ACTION TO BE TAKEN IN CASE OF INDICATION OF RISK.

When the Inspector observes or has reasonable suspicions that a shipment does not fulfill the proper conditions with regard to nuclear safety and radiological protection and therefore it could constitute a nuclear risk in its surroundings, he will immediately inform the title-holder of the "Authorization of transport" or his representative and the competent authorities (Customs, Airport authorities, entrance point or border, etc.), recommending that steps be taken to correct the situation and isolating the material as much as possible. All actions taken should be reflected in the report issued "in situ" and handwritten, if necessary. In any case, as soon as possible, he will inform JEN and the Delegation of the Ministry of Industry (by telephone, telex) who will give the pertinent instructions. Until the competent authorities have been duly informed, the inspector will remain "in situ" awaiting instructions or to counsel the Authorities.

If no "risk" of a nuclear accident is observed, but if the contents of the shipment cannot be affirmed by means of the sender's certificate (in case some is missing) and/or if the transport authorization granted by the Energy Administration Board is not exhibited, the inspector will inform the authorities...
so that they may decide what should be done. If the inspector is requested to give his recommendations, he should recommend that the entrance or exit to/from the national territory of said shipment not be permitted and that it be intercepted to avoid possible risks.

CLOSING THE STATEMENT

That the airport, port, border officials, etc. have given the necessary facilities to the Inspector for fulfilling his mission (if applicable).

This Statement is issued in the place and date indicated below, in accordance with that indicated in the current Law 25/1964 and the referred Resolution.

Place and date (in writing)

INSPECTOR'S SIGNATURE

PROCESSING= In fulfillment of that provided in the present legislation, an authorized representative of ____________________ is invited to sign, date and indicate his agreement or disagreement to the contents of this Statement.
1. If accompanied, indicate the name and title: JEN Expert, Provincial Delegation Engineer of the Ministry of Industry, etc.

2. Define specifically, for example: Port of Santander, Barcelona Airport, Vandellós Nuclear Power Plant, Irun Customs (Guipuzcoa), Km. 92,300 of National Highway No. 1, etc.

3. Transnuclear Española, Union Electrica, SA., Mr. _______________ title-holden of building or operating authorization of radioactive installation ______________, company ___________, etc.

4. Person he proved to be (National Identity Card or other document exhibited), he said to be (if same is not confirmed), or is (if the Inspector knows him).

5. The number of packages and characteristics will be specified: irradiated fuel elements, natural uranium or enriched fuel elements, encapsulated radioactive sources or non-encapsulated cobalt-60, iridium-192, iodine-125, etc.; if they are radioactive products or wastes, mention will be made if these refer to nuclear substances.

6. If the certificate is not exhibited, specific mention will be made that the Inspector has requested same but that it was not shown. This point is of great importance.

7. For shipments which enter or leave Spain, it is necessary to always check that the sealed bands are intact and especially when this refers to radioactive material subject to safeguards.
SESSION V

PANEL DISCUSSION:

CHAIRMAN: VOLGENAU

DOPCHIE: As far as general public information is concerned I would like to say that in Belgium, under the parliamentary groups, they have grouped into a sort of federation called "Interverenvironnement" and those people are active regarding information and trying to canalize it. Two years ago, the government did establish a committee for the examination of the future nuclear energy in Belgium and this committee is called "Wisemen Committee", they produced a very large report and in this report, among other things concerning nuclear energy, the question of licensing and inspection was discussed and was largely explained. Several objections and several changes have been brought up, of course. This report is going to be debated in the parliament probably next year.

As far as incidents and accidents are concerned, there are two ways, one is that the licencsee gives himself, tells the news media what has happened and what he is doing in his own way. Second, the Parliament, that normally puts questions to the Ministers, the Ministers will refer to the Administration and the Administration will then come to us and then we are trying, and only then, to give them an accurate report, as accurate as we can deliver it at that moment, but usually after consultation with the operator in order that we would write things that would not be debated by the operator. It will be acceptable to the operator and still be accurate and complete.

VOLGENAU: It is important to note that Belgium has a very big percentage of their energy which is provided by nuclear power, I believe it to be in excess of 20%, and it will grow, as well as in Sweden, which is another
case of high percentage power generated in a nuclear way. Let us now hear Mr. Beare.

BEARE: The Atomic Energy Act, in the framework on which the Atomic Energy Control Board operates does not give the regulatory authority in Canada, powers to provide public information. The emphasis in the Act, because it dates from 1946, was concerned with security and secrecy. In this respect, we have a clause in the regulations by which the information that the Board, or the Regulatory Body Authority, gets from the licencsee is an individual privilege and cannot be released without the permission of the licencsee. So no self-respecting regulatory organization is going to allow this information to be censured by the licencsee so, there is no information programme. That was the case until several years ago and since then, public comments and some opposition in nuclear power have been developed. Before that there was a large margin of indifference and therefore there wasn't really much need for public information programmes and any public information was released by the utilities or by the promoters of nuclear power and this tended to be very bland and assuring to the public. In the last few years public pressure has been growing and already has had some sort of effect, for example the membership of the Board which is composed by five members, one of which is full-time member and others are part-time. The composition of this Board has changed substantially. Prior to a couple of years ago, presidents came from the nuclear industry and since a couple of years we have the first president who is not and does not have nuclear background, he has a public service background in another area. Also two of the members of the Board, one of which was president of Nuclear Limited, that is not the case any longer, and another was president of Atomic Energy Accountants Limited and again it is no longer the case. So, there have been some effects within the Board and the
coming president, when he saw what the situation was, on recognising that pressure to public information would be growing, anticipated this and initiated a revision to the legislation. So, he started obviously such initiative and it is up to the Government to complete and carry through. We expect within the next few months to see a draft legislation or first reading of the bill to appear in the Parliament. Of course, this is a question of governmental priority, when exactly is introduced I don't know. We do not expect to see a 180 degree change but may be it is 150 degrees. So, my interest in this aspect is to find out what has been practised in the nuclear regulatory bodies going from, essentially, secret licensing process or confidential ones into one which is much more open, that's why I am so interested in those who are making this transition.

MØLLER - MADSEN: You might be aware that Denmark is one of the industrialized countries in Europe which hasn't got nuclear power stations, neither under construction nor under planning. The Danish government has postponed the principal decision on nuclear power and we do not expect a decision in the nearest future, not until certain matters, for example financial matters and some important safety matters (for instance physical protection and disposal of high level waste), have been thoroughly reported to the government. Therefore, you might find my remarks today rather academic. Although we have not got nuclear power stations, we have already got opponent groups, there are very strong opponent groups in my country which have the ear of the mass media. In the absence of nuclear power stations the focal point of the Danish opponent groups has been the Swedish nuclear power station in Barsebaeck which comprises two units. Barsebaeck is situated about 30 miles from the city of Copenhagen which has more than one million inhabitants, and that fact has given raise to a very intense, and some times very emotional public debate. The attitude in the Inspectorate, and in Denmark as a whole, is that public access to official documents is, in principle, very much like the Swedish one, although I think
that the Danish legislation is not as progressive as the Swedish. It is
my personal impression that the public have not, until now, used the
their right to have access to the documents as they have in the legisla-
tion. We have foreseen in the legislation, covering the licensing process,
a system of public hearings or inquiries, but it hasn't been worked in
detail how these hearings shall be performed.

VOLGENAU: Dr. Eurola, would you care to make any comment on the Finnish
public information program?.

EUROLA: In Finland, we have not so far established any formal system of
information on inspection activities. We have so far mostly dealt with
the construction phase of power plants and not with the operational phase.
In this view there has not been any such system of information and I think
we do not even, at least now, plan to inform on the activities of inspection
concerning the construction, but we are planning to adopt an information
system on the operation of the plants in quite a similar way that the
Swedish have done. This means that there will be quarterly reports, at
least, addressed to the Minister of Trade and Industry as well as to the
licensing body, and there will be special reports from our part on the
incidents, but the matter has not been discussed whether these reports
will be sent to certain, let's say, key places where they will be readily
available; certainty they will be readily available at our offices.
Going back to the question of informing about ourselves we have written in
several articles, in technical periodicals, and in fewer cases also in
the daily newspapers, what we are, what are doing and so on. Some of the
newspaper articles have dealt with special aspects like survey of the en-
vironment, but at least once, we have had a very thorough article about
the complete scope of the work, the way we are working and so on, in the
biggest newspaper of the country and the main author of this article is
sitting next to me, Mr. Laacksonen. In our country, it is the role of the power companies to inform about certain aspects, like at what phase the power plant is and so on. They have informed that now the pressure vessel has arrived and they are glad to inform that the plant has reached criticality and such reports you get from their side. Certainly, they will also, in the future, if there are any accidents, make their own contribution.

A couple of words about the access to reports. In principle, the records are free to the public if they are records of any governmental organization but, of course, there are also exceptions, like Mr. Ekered mentioned in Sweden. If some item is provided for us, for inspection, and is classified as confidential or proprietary, of course, we keep it that way. In the legislation there is a provision for that too, but in general, if anyone wants to come to our files, there are at least final decisions on any aspect of acceptability of pressure vessels or whatever it is, they are freely available.

SERVANT: Je vais essayer de répondre à votre question en deux minutes seulement. Je voudrais dire d'abord, et enfin nous le ressentent tous, je pense qu'à la suite des discussions qui ont déjà eu lieu, l'information publique pose de problèmes qui sont manifestement de nature un peu politique. Je pense que sur ce point, au fond, ceci nous renvoie à un principe général qui découle non pas des textes proprement nucléaires, mais finalement de la Constitution et des Lois Organiques, d'une démocratie qu'on peut dire de type parlementaire et dans ces conditions on peut dire qu'au fond les services publiques rendent compte au seul ministre responsable et au gouvernement. Les ministres, bien entendu, informent le parlement et lui rendent des comptes. C'est ainsi, et vous le savez peut-être, que nous avons eut en France un débat parlementaire au mois de mai 1975 sur les problèmes de l'énergie nucléaire et que nous en aurons peut-être un nouveau dans les semaines ou les mois qui viennent.
Les ministres informent également les préfets qui sont, comme vous le savez sans doute, les représentants locaux du gouvernement, lesquels ont la charge d’informer à leur tour les assemblées élues sur le plan régional ou local et je précise que ces assemblées dans beaucoup de cas, c’est-à-dire, dans les régions où existent des centrales nucléaires, ont constitué des commissions spécialisées sur les problèmes nucléaires en incluant quelque fois dans ces commissions de personnalités non élues. Enfin, les ministres informent, bien entendu, directement l’opinion du grand public par la presse, par la radio, par des publications; c’est ainsi que le Ministère de l’Industrie Français a lancé il y a maintenant deux ans, une collection de monographies sur l’énergie dont plusieurs tomes ont été consacrés à l’énergie nucléaire, l’un d’entre eux plus spécialement encore à la sûreté nucléaire. Alors après avoir parlé des ministres, je dirais un mot des fonctionnaires, c’est-à-dire, de l’Administration proprement dite. Manifestement, les fonctionnaires dans ce domaine n’agissent qu’au nom des ministres ou par délégation des ministres, ou du moins avec leur autorisation. Quand ils peuvent participer à l’information des assemblées élues, généralement pas au parlement mais dans les assemblées locales, il arrive que des fonctionnaires aient participé à des débats, à des assemblées élues et même, dans certains cas particuliers, les fonctionnaires peuvent informer directement le public avec l’autorisation de leur ministre. Ces fonctionnaires préparent également des rapports, des réponses aux questions du parlement et des notes d’information sur les accidents sur lesquels je reviendrais dans un moment. Que dire des organismes, des établissements publiques qui ne font pas partie directement de l’Administration et qui sont un peu plus loin, donc, de la responsabilité directe des pouvoirs publiques? Ces établissements publiques disposent d’une liberté certes plus grande, d’une plus grande souplesse pour informer et pour publier dans le domaine nucléaire. C’est ainsi que Electricité de France et le Commissariat à l’Energie Atomique publient des rapports et
des publications de caractère technique, les plus souvent sur les problèmes de sûreté nucléaire. On me faisait récemment, aujourd'hui même, observer qu'un rapport qu'a préparé le Commissariat à l'Energie Atomique avec son personnel et les syndicats sur l'usine de La Hague, vient d'être tout récemment publié, et si j'ai bien compris il est déjà largement diffusé même à l'étranger. Donc, toute cette action, bien entendu, des organismes publique se fait de façon libre et simplement, on peut dire, dans le cadre d'une politique générale qu'a été définie par les pouvoirs publiques. Je voudrais également dire un mot des enquêtes publiques qui sont faites à l'occasion des différentes demandes, disons dans le cadre du "licensing", et cette information se fait de deux façons; d'abord, les dossiers qui sont présentés en cette occasion, sont pour certain d'entre eux accessibles au public, et par ailleurs les questions qui sont posées par le public à l'occasion de ces enquêtes appellent des réponses, et un décret récent a précisé que les réponses à ces questions devaient être rendues publiques. Je signale aussi pour mémoire qu'une loi, également toute récente, sur la protection de la nature a prévu que les études d'impact sur l'environnement deviennent maintenant obligatoires en France et doivent être publiés. Je voudrais dire alors que, en revanche, les autres dossiers qui sont remis à l'Administration ne sont pas à priori publiques, c'est un principe général de déontologie de l'Administration quand on envoie à une administration un certificat médical, un extrait du caissier judiciaire, on serait extrêmement étonnés de retrouver dans une déclaration publique le contenu de ces documents; donc, ce principe général s'applique notamment aux dossiers qui sont présentés dans le domaine nucléaire ces dossiers au fond, demeurent la propriété des personnes qui les ont présentés. Il n'en reste pas moins qu'il y a sans doute un effort à faire de ce côté là et j'ai personnellement engagé très instamment les exploitants français, notamment à Electricité de France, à préparer de versions publiques des rapports de sûreté qui sont présentés à l'administration.
L'administration ne rendra pas publiques les rapports de sûreté mais on peut parfaitement concevoir que l'exploitant, lui-même, rend publiques les dossiers qu'il présente ou du moins la partie qui ne contient pas de renseignements de caractère qui sont secrets par leur nature. Sur les accidents ou les incidents, je dois dire qu'il n'y a pas de réserves sur une information complète et rapide du publique, d'abord pour les exploitants eux-mêmes et c'est ce que on disait tout à l'heure des États-Unis, et bien entendu par les services responsables de sûreté qui préparent dans la plus part des cas de communiqués de presse qui sont immédiatement remis à la presse. Il y a cependant une réserve que je tiens à souligner sur tout étude, toute statistique qui tend à placer l'industrie nucléaire dans des situations différentes et particulières par rapport au reste de l'industrie. Je dois dire que sur ce point j'aimerais qu'on revienne là-dessus tout à l'heure à propos de l'exposé de Mr. Gausden. Il nous a dit que les exploitants étaient gênés par tous ceux qui tentent à singulariser l'énergie nucléaire.

J'ajouterais qu'en France les pouvoirs publiques eux-mêmes ne souhaitent pas que l'on ne singularise de façon excessive l'industrie nucléaire à l'égard des risques qui sont présentés pour la sécurité en général. Donc, je conclus si vous voulez, en disant que la politique des pouvoirs publiques français est d'informer très largement sur les contenus techniques des dossiers pour répondre aux interrogatoires, aux inquiétudes du public avec certaines réserves, les plus évidentes concernant les problèmes de protection contre les actes de malveillance et tout en veillant également à ne pas alimenter la contestation à partir des informations qui seraient mal présentées ou insuffisamment commentées. L'un des problèmes plus difficiles, je crois qu'on y a fait allusion, c'est précisément ce problème de présentation sans une forme claire et compréhensible d'une information qui étant elle-même difficile et qu'on souhaite en même temps exacte et
honnête. Je concluirai en disant que récemment le Président de la République lui-même, a annoncé la création d'un conseil de l'information nucléaire qui devrait d'après lui, préciser les conditions dans lesquelles pourrait être précisée la politique en matière d'information nucléaire.

VOLGENAU: It is indeed interesting to hear the French initiatives in this area, particularly in view of the increasing concern plants safety. I think at this point I will ask Mr. Messore to speak about their public information.

MESSORE: In Italy, we don't have a public information program. I think that as we have no strong reactions about nuclear stations in Italy, probably this is a possible reason for it. So far, the information is given to the public through the owners of the plants. Of course, it is not the best way to give information. We have a real official channel to give information outside the CNEN and it is the office in charge of the inspections with the annual report that we have to write for the Minister of Industry but this is a report just about our activity and is not really useful to give information about actual operation of the plant. Sometimes, it happened that the Parliament put special questions about specific problems raised by its members. On these occasions, of course, our President asks us to write something about a special problem; the problems are solved, case by case and not as a general practice. There is another possibility to give some information to the public, but it is not about plant operation; this is in the framework of an official task that has the CNEN to support the Administration about the decision on the sites of the nuclear power to be built. Exactly this week, yesterday and today, we have a debate in the Parliament about the nuclear power program. My point of view is that if Italy would choose again, as it was in the 60's, to build power stations as we need, probably, as I said before, we will decide to
set up a special system to give the people all information necessary to accept wide programs of nuclear power stations in Italy.

VOLGENAU: This has taken more time than we had intended and I think in view of that I would like one more representative from Spain, Mr. Trueba, to speak.

TRUEBA: Thank you Mr. Chairman for giving me this opportunity. In Spain, the situation is the following: the inspection reports and all the documents relating to the licensing process, construction and operation form a file which is in the archives of the J.E.N. This file, which includes our information is kept, up to now, confidential and it is not the practice in our country to give periodical information about operation or incidents in the power stations; we do not have, like in other countries, "public document rooms" where the technical file of the power stations can be consulted. All this documentation is official and has the same rating as the official documentation belonging to the Administration and there are no exceptions to the rule.

There are only two cases where information is given to the public, the first of these is the application for the preliminary permit for the site. The law requires that the Provincial Delegations of the Ministry of Industry publish the application, so that the public has access to the project of the power station. Then the public have 30 days to study this project and make the allegations they may have against it. The second case is when the public authority, the Ministry of Industry in the Spanish case, decides to give the permission and this is published in the Official Bulletin of the State.

However, as this is an official documentation and in agreement with the law of the land, anyone interested has the right to ask whatever he likes following the regulation channel. The authority judges the convenience of giving this information, what kind of information may be released and
whether it is or not restricted in the benefit of the public interest and of a better acceptance of the nuclear programm by the country. This is all I can say about the access to information.

There is also another problem which arises in all countries and this is the opposition to power stations. Really, in Spain we do have a strong opposition to nuclear energy and it is a problem for the authorities how to explain to the country why it is necessary, which are the advantages and the disadvantages. It can be said that all this started three years ago in a very strong manner and since then we try to inform the country what the actual situation is. According to our experience, at least my experience, it seems that the real worries of the country are the political problems, general opposition of the public, the doubts on the Administration doing a good job, if the necessary control exists, if the safety of power stations is studied. The first effort has been the presentation of the systems being used in Spain, what is being done to guaranty the safety of the public and also to justify the need, from the point of view of the energy crisis, to install power stations, but of course, guarantying the necessary safety to the people. On the other hand, perhaps it is interesting to underline that the policy is to tell the truth and we are now in a very interesting period, from the political point of view, where in a few months the parliament will try to review the actual legislation and hear the public opinion and demand explanations from the technical organisms as the J.E.N. or the Ministry. Up to now, there has not been any demand concerning technical explanations but there has been, in general, a demand from the side of the press and we hope this will change in the future.

VOLGENAU: Are there any questions pertaining to the papers that were submitted earlier?

PERELLO: I should like to make some comments on sentences by Mr. Volgenau and Mr. Trueba. The first one is whether it is really necessary to gain
the confidence of the public to be able to go on with nuclear programs. Mr. Trueba said that the public in general, and I agree completely with him, has some doubts about the Administration doing what it should. I believe that the problem is not only to make happy those persons who are disquiet, normally it is a very small percentage, and I think that we should satisfy the mass media, the majority who normally take less part in the unrest situations, (more or less violent), but are finally giving confidence to the Administration. For instance, our Chairman has given a large presentation on how they proceed in the U.S. and I believe that the person who is really interested can find the available means to solve his doubts. Don't you consider that perhaps a large explanation will put aside many people who have no interest in knowing the technical problem?. What they really want to know is if the whole thing is studied by whom it belongs. Then, I will suggest that the main documents, as the authorizations are, will include some clauses giving an answer to the main problems presented by the people affected by the installation concerned. During a visit to Germany I have had the opportunity to see an authorization form and besides the technical conditions, which are really necessary, there is a series of points where there are explained the questions put by the people affected by the installation. Of course, the name of the persons putting the questions are not on the form but the real fact. This can give the opportunity to those putting the questions to react if the point they summited has not been considered.

GRONOW: Mr. Chairman, I have got the first part of the comment. Is it necessary to win the confidence of public to go ahead with nuclear power programs? I think it is necessary to show the public that you can answer and deal with small minorities and I think that all processes which we are talking about are, in fact, dealing with questions from small minorities; but it must be then shown to the mass of the public that we can deal with them, that there were no lack of confidence in our ability.
DOPCHIE: Mr. President, I will address this question to you if I may. You said you are actively encouraging the licensees to issue their own statements concerning incidents at their facilities. Now, I would not doubt that their statements will be correct but, don't you believe that they will have a tendency to hold some information about the faults that they might have made, for instance, not having followed a written procedure? Do you believe that they will make that statement quite clear? That they did not follow the procedure, that they violated some rules? In other words, that they possibly would not say the truth?

VOLGENAU: That is typically what happens in a case like that. If the company or the utility will make a release, and if we, NRC, feel that the release needs to be extended upon, we will make our own amplifying release, if we do not make a release and the company does, we frequently will receive an inquiry from the news media. So, I think the situation is selfcorrecting. Any desire on the part of the utility to give a self-serving news release, is complemented by the NRC.

GAUSDEN: Again I address my question to you. In U.S. probably you have more experience than any other country about providing public information. As far as NRC is concerned, have you any estimate of the extra effort, said in percentage terms, required to satisfy these requirements from the staff point of view?

VOLGENAU: That is a very good question and, as a matter of fact, it happens to be budgetting in the U.S., that means that I prepare my budget and I take it first to the Commission and from there to our Office of Management and Budget and then after that I must testify before the Congress. One of the things that we have in the process of accumulating, is the amount of time that is spent simply providing public information, particularly with regard to "Freedom of Information" requests. Now, there
is a very specific way for dealing with those questions. A legal way, it must be responded within a certain time and in a certain way. I find that I have one person essentially full-time responding to those tasks of requests and this doesn't include any of the other time which we spend responding to the inquiries from members of Congress and from members of the public, but we have a data system which we use to the benefit of the time of our professional work for us and we are now making a new entry so that we keep better records in that regard. It is at least one man year for "Freedom of Information Act" requests and probably more.

PEDERSEN: I think NRC is in a hurry to adjust to the Freedom of Information Act which you correctly pointed out in small portions of our obligation to make information public and I believe the estimate is 14 complete man-years effort, at least in the past fiscal year, and this is only the time which can be easily identified and placed directly upon that activity. Many people feel that it is in fact too low, I think it is somewhat above that, but the official information, I believe, we supplied to the Congress was of 14 man years.

ACHA: One thing is the public information and another thing is the acceptance of the public regarding nuclear power stations. I should like to ask the Swedish representative which are the real repercussions of public information on the Swedish nuclear plan.

ECKERED: I will say that it is impossible to draw one's conclusion about our information efforts and the acceptance or not acceptance of nuclear power which is a political question. I see our effort as a natural and necessary part of our work to give, to write the background of information to the public, and to the politicians, and to other interested. The other part of acceptance or not acceptance is, let's say, independent from what we do.
PERELLO: I consider impossible to arrive with information to the mass media and that the mass media will appreciate the position of the governments and technical bodies related to nuclear power. I think the best way to convince them is to consider the nuclear work in the power stations as one additional activity within the industrial activities of the country. Then, the information should only be directed to those minority groups that on many occasions and with a double intention try to disturb the public information. The mass media will remark in the coming years that the nuclear activities have the same risk as any other activity within the industry. This means that we have the same attitude as with traffic signals when we mark and signal all around we indicate with our finger a certain danger. Perhaps with this oppressive information we are indicating or creating a restlessness which really doesn't exist.

SERVANT: Je voudrai reprendre un peu la remarque qui vient d'être faite, elle va un peu dans le même sens que celle que je faisais tout à l'heure. Il me semble que, disons très schématiquement, les politiques qui nous ont été exposés dans cette salle, peuvent se ranger en deux catégories, celle qu'au fond traite l'information en matière nucléaire comme l'information dans toutes les autres matières industriales ou de sécurité industrielle, et puis les politiques qui au contraire font un statut particulier aux problèmes de l'information en matière de sécurité nucléaire et ceci me paraît un problème un peu, disons, philosophique, important, qui déborde même le cadre de l'information. Nous sommes, ici entre nous, tous convaincus de l'importance de la sécurité nucléaire, si non nous ne serions même pas ici. Je dois dire cependant, que, lorsque l'on discute avec, par exemple, les représentants d'autres ministères, on se rend compte que leur soucis sont souvent bien plus grandes pour d'autres domaines de l'activité industrielle, de l'activité humaine que pour l'activité nucléaire. Alors, il me semble que la politique que nous essayons de définir doit s'intégrer en une espèce de soucis d'homogénéité des mesures
qui sont prises dans les différents secteurs de l'activité et il est certain que si nous singularisons à l'excès les problèmes de l'énergie nucléaire, nous inquiétons la population et nous obtenons l'effet inverse de celui qui est recherché. En outre, j'ajoute que de façon très objective ceci conduit à un certain gaspillage de l'effort publique qui peut être fait et, qui comme nous le savons tous, est limité. Tout ce qui sera fait pour nous prémunir contre de risques exagérés dans le domaine nucléaire, ne pourra pas être fait dans d'autres domaines où quelque fois l'action est plus urgente. Alors, ce qui est dommage c'est que dans la plus part des pays, et je pense que même au niveau international c'est la même chose, nous n'avons guère de centres de réflexion suffisamment multi-disciplinaires, couvrant l'ensemble des activités industrielles pour faciliter cet approche global du problème de la sécurité et pour essayer de classer chaque secteur avec sa véritable importance, et même si de tels organismes existaient, j'admets volontier que dans le court terme le problème ne pourrait être traité uniquement de façon technocratique en fonction d'une "appréciation objective" de risques et qu'il faudrait tenir compte de l'inquiétude du public, mais je crois qu'à longue terme il faudrait tendre vers cette rationalité des approches dans les différents domaines de l'activité industrielle.

COURVOISIER: I would like to come back to a more specific question. I am worried about what was written or said in between the lines, that the publicity in our activity as inspectors may be counter productive to safety if it comes to situations where nothing is put on paper any longer, discussed only over the table or somewhere in the plant, in a corner where it is noisy, where people can misunderstand each other. I am afraid that very much of safety will be lost. Could anyone comment on it?

VOLGENAU: I see that we are approaching the end of our session and I think that Mr. Dabek had some summary comments to make. Perhaps you
could address Mr. Courvoisier's question within the context of your comment.

DABEK: I would like to give some information concerning the activity of IAEA about the regulatory information program. This problem, as results from this session, from these discussions is quite important and quite difficult. In all member-states, practically, these problems are handled differently because they are depending on various parameters such as, for instance, constitutional and legal statutes in a country or a member state and other parameters like habits and so on. At the Agency we have encountered those problems and so, in our program on nuclear safety standards in the Code of Practice on Governmental Organization, on regulations for nuclear power plants, when some aspects of public participation in the licensing of a project have been drafted; after heavy discussions there remained few aspects; for instance, it is stated that in some member-states, the public participates in the licensing process. Also, it was suggested and discussed on the list of safety guides the preparation of a guide on establishing and maintaining a regulatory public information program. The content of this guide has been discussed in the TRC, Technical Review Committee and in the S.A.G., Senior Advisory Group, and they came to the conclusion that this guide is so difficult that it was postponed to a later date. An international guide should represent member-states practices particularly practices of member-states with well developed nuclear power programs and it is intended to give guidance to member-states which are initiating nuclear power programs. To give guidance on these matters to the member-states is a very difficult problem, that was one reason, and the second one was that not enough material on which such guide could be based was available and therefore it was postponed. Now, I think next month there will be a TRC scheduled discussion on the program for the next two years and probably after this meeting there will be more material as there are more members of the committee participating in this meeting.
VOLGENAU: I note from your comments as well from other comments heard, and from the papers, that, in summary, public information aspect, as it pertains to nuclear safety and specifically to inspection activities, appears to be increasing in most countries; that means a great deal to those of us who are concerned with the technical aspect of our job, because we get involved more and more in public affairs and the question that Mr. Courvoisier raised concerning public information might, in some way, detract from safety because of items left up through or other concerns on the part of public officials. It is not in my way of thinking a very serious concern, at least not in our country, because we, in fact, must document in very great technical detail all our notices of violations and be prepared to defend them in court, so we try to have clear cases before we take some type of actions against the utilities. I think at this point then, we should terminate this session and I remind you, those people who wish to bring comments to the final panel, particularly specific recommendations, should give their comments to Messrs. Gausden, Ilari or Stadie. Finally, are there any other administrative announcements?

STADIE: I think we have discussed this morning a problem on which we all have become rather conversing over the recent year. One could go on hours and hours talking about it. One question we have asked ourselves in the Secretariat is why is there so strong opposition in some countries?. But, I agree with you, as a general principle it has not increased everywhere and it is much less in other countries. I think this would be a very interesting topic for discussion and perhaps you could touch it to some extent in the final panel this afternoon, if there is some time left, and I think we could benefit from each other on a more elaborated discussion than we have done so far.

This morning we primarily heard what is happening in different countries and not really analyzed why it is so difficult in one country to convince the public that nuclear power is necessary and in another country it is easier.
VOLGENAU: I suggest that you put comments on this in writing and submit it to Mr. Stadie for application in the final panel. That's all for this morning.
FINAL PANEL DISCUSSION
CHAIRMAN: GAUSDEN

GAUSDEN: Mr. Courvoisier, it is your turn of comment.

COURVOISIER: Mr. President, that I've been up here I'm not sure that I am privileged, I have evidently stuck my neck a little bit too much and that is why I am here. I couldn't make any concise contribution as the session chairmen can. What I would like to do, is to leave over to a model and some points repeated in discussions on what we discussed previously in this meeting. May be there is a point which could be taken out from what was said earlier on this panel. What I would like to know are the aims and the rationale for each sector of inspection for components, electrical equipment, buildings, health physics, radiation protection and even for the selection, training and acceptance of personnel. I hope to get more information on the ideas the different countries do have and followed on these five domains where inspection is active and I feel there is no good equilibrium, so far, between the inspection effort which goes into these different inspections. One problem that bothers me since quite some time is the problem of responsibility. There is a maxim saying that the responsibility rests with the operator; I wonder whether this does not preclude any inspection. The operator might say what do you do here? I am responsible. Of course this is an extreme. I have never heard an operator say that, but what would we inspectors answer him if he would say it once? Well, the maxim might not hold under every circumstances, for instance in my country there is a general law from the Federal Government that says that the Government is responsible if one of these servants commit a wrong act of government, as the lawyer says. But, it is the Government who is responsible and not the man himself. The Government might later have a few words with him but, as it regards the third part, is the Government who is responsible. Mr. Kellerman has answered a question and said that the TUV's are responsible and have even taken out
an insurance in case that something goes wrong and they are held liable. So the maxim is not a complete one; there is no discussion that the maxim is correct as far as liability against third parties are concerned. If something happens at a nuclear power station, it is the operator who has to take out the necessary insurance.

A third question in that context will be, even if it turns out, and I will welcome a study to be made of the true position of the inspector in the different countries, I repeat that even if it turns out that we have no legal responsibility as inspectors, I wonder whether it is fair to say that he is the only one who hangs?. Aren't we at least morally responsible?. Are we responsible only in so far as we inspect?. Aren't we responsible as well as we do a bad job in reviewing and assessing the lay-out of a station during the pre-construction period?. We have in fact in those capacities a sort of check-valve function, I would say a check-valve function which should never become a mouse-trap function for the operator. If all goes well the check-valve is open, if something goes wrong the valve closes but I think all of us refrain from giving exact orders to the operator, how he should correct a situation where the check-valve is closed. We must refrain from giving him exact orders how he has to overcome his problems, because if we do that, we take definitively a responsibility that it works, that we will accept the result. So, I have just sketched a little bit what my worries are in the domain of responsibilities and I'll be happy if any aid could go into this and make not only an inquiry what is the responsibility in your particular countries, but ask for the rationale behind it. I have to ask my lawyers different times what my responsibilities actually are and often trying a little bit to answer, they stop and scratch their heads and say: "Well, if something happens, we will tell you what your responsibilities would have been". That doesn't help us, we want to prevent things and so we want to know beforehand what is the responsibility that we have to fulfill.

Another problem is the relation to the operators; there must be a climate of reliable cooperation and mutual trust. Open and reliable cooperation were said repeatedly, but mutual trust I haven't heard. I insist on this because if we cannot trust each other to a certain extent, we have to stop every
business in this world. Whatever we do as human beings in a group, it needs trust from one to the other, otherwise everything falls in the pit. If this climate is not present, the inspectors will get only information on what they have specifically asked for; the operator will try to hide whatever he can and as long as he can. This was touched upon several times but I would like to stress it again. The inspector would then, in such special climate, have to look himself unless this will still be worse as regards the climate, he hires an operator as a sort of spy. I am afraid that the good climate of cooperation is spoiled by having unannounced inspections. The operator, at least I would feel it if I were an operator, feels attacked in my view. This applies probably more to the operational phase than to the construction and commissioning phase, because during construction and commissioning there is always need to organize things beforehand because too many parties are involved. What is the position of the inspector relative to the operator once he has been fined? I do not want to say that you will not have to fine an operator if he really does something which is very unpleasant, but the situation of the inspector "vis a vis" of the operator may be much more difficult once this has happened. I think both sides know that. Maybe we can hear a little bit more on that. The inspector must keep a certain distance from the operator, he must not become too familiar with him, I have the picture of the customs officer becoming a smuggler, but that doesn't really fit; the customs officer is there to stop smuggling and the inspectors are to see that the plant runs, but runs well. This is an important difference, so, please forget about my metaphor.

In reporting, we have had this rather extreme, the example of the Swedish system. I wonder whether the reporting isn't just a question of how long is the leash on which you carry your dog; if the leash is too short, I am afraid the connection will be so hard that it will be difficult to see who leads, the man or the dog. Mr. Stadie went to an extreme, he envisages the centralized authority which gets via some system of transmission all the data of all reactors at any time immediately. This ends up in having operators in the centralized authority, the so called operators sitting at
the panel looking at these data and then, of course, they want to act. It is impossible to look at data and do nothing about it, at least after a short time. So, this would mean that we have two operators interfering with the same plant and I asked Mr. Kellerman at that time whether we needed three operators, as he believes in three independent people looking at components mainly. Now, is this a tendency that we really want to have? The operators are human beings. What is their reaction if they have to feel like being looked at by big brothers all the time? I think it is impossible to stand this situation, I would resign as an operator. Now, evidently, this goes much too far, but where is the optimum as regard transmision of data to the inspection authority and as regards the reasonable human relations and reasonable human reactions? I don't have the answer, only I have a question. These are the problems which, for me, have remained.

DOPCHIE: Il a été largement question de ma proposition que a été rappelée récemment par Mr. Servant. Je propose donc, qu'on définisse les matériels, les équipements auxquels l'assurance de la qualité doit être appliqué. Mr. Jeffrey et moi-même avons soulevé cette question, et d'autres aussi d'ailleurs pendant la première session. Je vous rappelle qu'aux États-Unis cet équipement est défini par le règlement 10eFR50 comme étant le matériel "safety related", en relation avec la sûreté. Je ne crois pas que ce soit la meilleure définition possible et je crois aussi que certains d'entre nous pensent comme moi, et qu'on pourrait l'exclure de certains matériel cependant liés à la sûreté des matériels qui ne doivent pas être soumis à l'assurance de la qualité et c'est pourquoi que je fais cette proposition.

GAUSDEN: I will come back a little later but I think there was another position from the floor.

JENSEN: My remarks follow to some extent the lines already given by Mr. Courvoisier. During the session we have heard from all the participants that the licence carries the full responsibility for the safety of his nuclear plant. We have also heard that some utilities must send daily reports
to the regulatory body. We have heard about resident inspectors at nuclear plants. We have heard that NRC is thinking about doing itself some of the testing at the nuclear plants. My comment is how long there may be exercised more and more inspection and still keep the idea that the licensee has the full responsibility for the safety of his plant?.

GAUSDEN: Is there anyone else who wishes to make a general comment or observation about things which have been discussed during the last two and a half days?.

PERELLO: I don't really want to make a comment but a proposal. This meeting on Regulatory Inspection is organized by the Subcommittee on Licencing of the Committee on the Safety of Nuclear Installation of NEA. I suggest, as a possible conclusion, the following proposal: the creation, within the Subcommittee, of a Working Group to analyse the principal common problems of touching the inspection of nuclear installations with the aim producing a report on the inspection practices, unifying the necessary procedures and criteria to accomplish a good inspection. This document, besides the unification of criteria, could allow a bigger profit for the small amount of the existing inspectors in all countries, because this is one of the points more insistently repeated.

GAUSDEN: We would probably find that there are so many variations due not only to practices which are growing up but to laws under way and things that are done in particular countries, which will make this almost impossible. Now, the point of view of coming out with ideas, recommendations which could be appreciable to OECD countries, I am not sure whether this is what you were suggesting.

PERELLO: I do agree completely with you, but my suggestion is more explicitly referred to the common problems. This proposal came to my mind at the end of the first session, when talking about general problems. Obviously,
specific problems and specially the legal, are intrinsic of each country but I ment the common problems and I believe there are a lot.

STADIE: As you may recall, I already counselled against too ambitious proposals emanating from this meeting. You are aware that these proposals would require CSNI approval and CSNI is already sponsoring a wide range of activities in the technical field and it would be more proven to approach this new area gradually. An acceptable framework for future activities and exchanges in the field of regulatory inspection would be to take the Gronow/Ilarai compilation further and to develop a permanent dialogue between regulatory authorities in this field. It is thinkable that a small group keeping this field in constant review would be acceptable to CSNI.

GAUSDEN: I think perhaps the suggestion here would be the one that we already heard from Mr. Gronow, that his proposals for updating and including further information in the document that he presented at the beginning of this meeting. Furthermore, Mr. Courvoisier made a suggestion that there should be a working party on legal responsibilities of regulatory bodies. I would suggest that this certainly doesn't require a working party, but it might be possible to consider some sort of information on those aspects, also in the document that Mr. Gronow was presenting. With that additional information, I think at least part of the problem which has been raised, may well be answered. Perhaps, it is to you to wait for that work to be done first and then see whether it really goes in some way to answer the problem you have raised.

We have a few minutes before tea break, are there any other comments, Mr. Stadie?

STADIE: My comment pertains to some of the recommendations made by Mr. Gronow concerning the updating of the compilation. I think there was a second proposal that he spoke about, appending the various licensing organizations; I
think this was too determinated as many of you know we already had a compilation of various licensing authorities and practises in member countries. What was meant here, I think that to append was primarily the question relating to the inspection and enforcement in this licensing regime.

GRONOW: I think it is primarily of giving sufficient explanation within the description and organization chart to enable interpretations on the way in which effort is distributed in the various countries. The reason I introduced in our discussion matters of security is because, if a certain organization has security responsibility and another does not have security responsibilities, the effort of inspectors, perhaps 10% of their time, is devoted to security matters and if the effort is not included in the general view expressed by inspection activity, we will not be able to defferenciate between nuclear safety considerations, security considerations and environmental considerations. Therefore, in order to make a precise evaluation of the difference in inspection practices, we have to have the allocation of the responsibility of individual inspectors when they visit a nuclear site, and this differentiation must be made so that we could actually allocate comparative evaluations of the different activities in the different countries, and that can only be done if you separate the function of inspectors in different regimes of control. I agree with you that the power chart will only be sufficient to enable us to understand the ways in which the various organizations operate with the view to expanding and understanding the regulatory inspection act.

PEDERSEN: Coming from a country where we don't make extensive views of outside consultants in our routine inspection programmes, I find very interesting to hear other countries talk about the prevalence they place on outside consultants to a system. I have also heard, however, the concern in the case of resident inspector, on the fact that he may lose his objectivity and become captured by becoming too close to the licencsee. My question is this: how does a regulatory body assure itself that this outside consultants are, in fact, objective when in many cases these consultants, or at least their
firms, may also be working for the manufacturers or for the licencsee and in many cases there are great amounts of money involved?. How can a regulatory body assure the independence and objectivity with that inspector on site or may have doubts about it?. How is he able to ensure itself of the objectivity of consultants, some of whom may be much larger than the regulatory body and some of whom may be very closely involved with the applicants and manufacturers who have been inspected?. This is a problem we don't have because we don't use the consultants. I'll be very interested in hearing other countries that rely very heavily on their consultants and how have they solved this problem.

GAUSDEN: Will anyone of the panel respond to this question?

SERVANT: Ma rémarque n'est pas sur la question posé mais plutôt sur l'intervention de Mr. Courvoisier reprise par le délégué Danois. C'est un peu, disons, un retour aux sources, à l'objective fondamental de l'inspection et il semble que, comme toute l'action réglementaire, l'inspection tend à réduire les risques, l'ensemble des risques à un niveau considéré comme acceptable et ce qui se pose pour nous, me semble-t-il, c'est la question de savoir si nous nous occupons bien des vrais problèmes, des problèmes les plus importants. Ceci est au fond la question de distinguer l'essentiel de l'accessoire, et dans ce sens là, il me semble que beaucoup de rémarques qui ont été faites, par example, celles qui concernent les fabricants des composants, ne sont pas forcément destinées à étendre la main de l'état ou des organismes réglementaires sur l'exploitant mais à s'assurer que rien d'essentiel n'est passé sous silence. Dans cet esprit, je me demande s'il ne faudrait pas s'interroger sur d'autres question que celles qui concernent la sûreté technique que nous avons évoqué ici mais, par example, les questions que concernent le transport, nous l'avons fait d'une façon tout à fait ponctuelle à propos de l'exposé espagnol. Je crois qu'il serait bon de connaître plus systématiquement l'action des inspecteurs en matière de transport et je pense aussi à la protection physique, "physical protection", contre la malveillance, quel rôle jouent les inspecteurs dans chaque état.
en matière de contrôle de matières nucléaires, peut-être même que rôle
joivent-ils dans le contrôle, la limitation de certaines pollutions prove-
nant des installations que sont les centrales donc des domaines qui ne
sont pas proprement nucléaires. Je pense notamment à la pollution thermique,
à la pollution chimique, enfin, à des questions qui se rapportent d'avantage
à l'impact sur environnement et il n'est pas sûr que ces questions, notam-
ment dans l'esprit du publique, n'auraient pas autant d'importance que les pro-
blèmes de sûreté technique dont nous nous sommes occupés jusqu'à maintenant.
Je crois qu'il serait assez bon d'étendre un peu le champ de l'enquête qui
a été faite vers des directions dans ces champs.

GAUSDEN: We had a question from the floor that hasn't been answered.

ECKERED: I think that the regulatory body will have to impose strong rules
on its consultants concerning to what extent, if any, they would be allowed
to do work for both the regulatory body and the utility. In a small country
like Sweden I would say it is rather easy to have a control over the consul-
tants and the role they do.

JEFFERY: I am just following on the point made by Mr. Pedersen and I agree
with the comments made by Sweden, that I think that the difference between
the two approaches is large due to question of resources. If one has the re-
sources to carry inspections within the regulatory body, I think it is, pro-
ably, a preferable way in doing it, but when one does not have the resources,
one has to get an independent view of this. Now, a question of resources
means that if you don't have the resource yourself as an independent body
in the regulatory body, then, one has to get the licencee to pay for this
inspection and then it is for the regulatory body to form a view to approve
as this independent body is truly independent. The difference in approach,
I think does come from the fact that it is mainly resources problem in the
first place; if you don't have the resources you have no option but to have
another independent body which has to be engaged by the licencee.
GAUSDEN: I think this leads us to break. Well, I think Mr. Gronow wishes to make a comment.

GRONOW: It is about Mr. Dopchie's comment. In his comment he says that he thought that we should not apply the Q.A. requirements which apply to the special parts because of the redundancy binding to the other systems, but redundancy is only as good as the redundancy of the component parts of the redundant systems. I believe it is wrong to suggest that redundancy must itself provide the necessary safeguard, because one can see that specific system tests would give good results initially, but that common mode failures and perhaps environmental conditions, which are not exposed simply by type testing, and system testing, might emerge simply because of poor quality control in the construction and fabrication, of perhaps, electronic components. You might get away with problems of this kind because of adequate redundancy, but most accidents occur because they are unforeseen, and you can get simultaneous fail to danger faults in protective equipment simply because of poor quality control coincident with other problems for which no unforeseen interaction was available to the safety assessment people. The policy of making sure that quality assurance, quality control techniques are being introduced in these other components, adds at least one more factor of safety for the unforeseen and the unknown.

DOPCHIE: Mr. Gronow is right, but the question is how far are we going to go. Not so many years ago there was no quality assurance, at least in the nuclear field, and the Americans with the 10CFR50 have applied it to anything that is safety-related, so my question is just to define somewhat better to what equipment and what extent quality assurance is going to be applied. It is not a matter of need but mostly of possibility: if you want to apply it to electronic equipment, you will have to start looking at a little copper thread that has been built, manufactured and then assembled and it will lead you too far. So, my proposition was just to define quality assurance and not to scape off, necessarily, of instrumentation or electrical equipment.
GRIER: I just wanted to say that this is the problem we have in defining "safety-related" in inspecting and enforcement regarding implementation of quality programs. We have asked the licensing office to establish a development office to formulate a regulation guide for our use as to what is meant by safety-related. Initial effort in developing these guides is to develop a list of components and systems to which quality assurance criteria apply. That turns out to be an impossible task as you might recognize, but there is an effort under way to develop some criteria for defining "safety-related" which will be published as regulatory guide, I hope, in an early date.

GAUSDEN: We now break until 16h50. I must remember you that we are limited by the time. This session will finish at 17h30 to allow Dr. Alonso making the final conclusions of this meeting, so, we don't have much more than 40 minutes.

ECKERED: I think what Mr. Jeffery said before the break was interesting. It is an advantage to have the resources in your own house, but I agree partly on, because I could give a good example that the advantage is not to have the resource in the house and that it could be better to have possibilities to use consultants. In the Swedish case, for instance, where we have had a program of nuclear reactors which was very rapidly growing and then will come to flattening out and might come to the decommissioning phase already in the light of the present political trend or one of the political trends will be the one which will dominate. Then, it could be very inflexible for us to have resources in the house for one phase of our work, and with the help of consultants we could allocate resources to the present phase which at the actual date is the most pressing. In the agency, we could use our money for consultants, for inspection work and for decommissioning if that will happen, without sitting a lot of people in our house not being useful for the work.

GAUSDEN: I'll give a chance to those who want to bring up a suggestion.
G. BERNAL: As a conclusion to this meeting I have drawn two aspects which I believe may very well be differentiated. One of them is the technical aspect, strictly technical of the inspection, which is the same problem for all the countries. The other aspect, which we could call a legal one, is settled down by the different laws or regulations existing in the different countries. I believe it will be interesting that this meeting, which is arriving to its end, will never finish and I mean by that, that it would be interesting that all the inspection bodies of the member countries here represented, as well as those which are not represented, should have a close collaboration in such a way that we could obtain a bigger effectiveness. In this sense, I think it is important to have a real interchange of all the information and I will complete it by some working visits, we all could collaborate making an effort inviting each other and have a season of inspection and, doing so, we could solve the common problems we actually have, we shall live them in more direct way. I believe that our mentality, that I insist is the same and common, we should arrive to interlace each other in such a way that this meeting will be really effective. It is just a comment.

GAUSDEN: Does anyone feel that this sort of idea is specific for debate?

ACHA: I want to stress the relationship between the inspection and the studies of nuclear sites. It has already been stressed but, perhaps, during these sessions it has not been given the real importance and, I stress it again, not only during assessment but also during construction and operation of the power station, it should be watched, for example, that the limits set are met. It could also happen that some of the parameters of the project such as seismology, hydrology and even demography could suffer variation during operation which could require some changes on the power station and I even believe that the inspection has some
importance once the power station has been shut down.

GAUSDEN: Is there anyone in the panel who has a comment on this?

BUERGO: In connection with the comments made by my colleague, Dr. Acha, I should say that, in fact, it is our experience that in relationship with siteing it should go deeper not only the assessment but also the inspection. We have encountered some problems of siteing of geological nature, and when constructing the buildings there have been difficulties of foundations, so that we arrived to the conclusion that it is necessary to define clearly the parameters which must be analysed and followed. This is our experience and therefore I insist on what has been said by Dr. Acha. We should be very pleased if some of you here could comment which was your experience and if you have had problems or consider the possibility that it has happened.

VOLGENAU: I think we have experienced difficulties similar to those that you mentioned and we have fairly standard procedures for dealing with them. It relates to the question of specialist and consultants for that matter and how big and specialised one makes an inspection staff. Customarily we use consultants, although not consultants who have any real potential interest with the industry. We also, in the event of a major problem of that type, refer to the licencing organization for evaluation, and there in terms of bringing experts to deal with the problem, and we have standard procedures for handling matters of that type. It seems that we are succesful with those standard procedures.

GRONOW: I would like to add some aspects to this problem. Insofar that when one takes a site and accepts it and does all the necessary foundations and examinations, etc., one still felt the possibility that in some future time new data may arise which invalidates the basis on
which the site is chosen. This may be a question of introduction of backfitting in various ways. There are cases where, for example, the industrial development in the area of the site introduces problems in connection with the criteria on which the site was selected. When a land is very valuable, when resources in terms of industrial land are scarce and some large organisation wishes to develop the land, then you have a conflict of what preservation orders you can make on that land. And certainly, it would require strict evaluation of the safety of the new industry enterprise that is proposed in the context of the safety of the nuclear installation. And these are aspects of problems which occur after initial selection of the site, and perhaps that might be of some use to the meeting.

GAUSDEN: Are here any other comments on this problem: Topic that anyone wishes to rise?

VOLGENAU: I like to react to a remark which I believe Mr. Bernal made a few moments ago and that concerns the value of an exchange like this. I have reflected under the meeting here on the past two or three days in an effort to try to see what could be learned and specifically what I learned, which could improve my inspection and enforcement program, and I guess I need to reflect a little bit more on that in perspective. Certainly, it is reassuring to talk with people who have other inspection and enforcement programmes that are not like ours, in terms of concrete ways for improving my programm. I have to confess I haven't found any immediate way, immediate result of this conference. However, there is a benefit to it that I can see even if I find no ways to improve my programm by benefitting from yours. I haven't given up my hopes in that regard and that is a remark that someone made that a nuclear plant accident in one country could very well affect other countries because of, for example, radiation fall-out if the plant happens to be near the borders of another country. I take that one step further and say that if there were a major nuclear plant accident in any part of the world, I think it would have a very great impact upon nuclear power in our country and
might well bring it to an end. Therefore, if I speak in selfserving terms, and I don't want to give the wrong impression here, but speaking for all of you in selfserving terms and for all of us, if we can in some small way contribute to the safety programm of other countries, I think that we will be serving the world well.

GAUSDEN: I think that's a very interesting observation, on which one could enlarge and fully support. Certainly, the problems of accidents happening to the rest of the world are of concern for all of us, I think day by day, and probably night by night as well. One variation on the point that has just been made, which I think about sometimes, is whether there is a situation which is depending to some extent on the reactor type or whether it is just a global problem. I don't know if anyone wants to comment on that.

No, perhaps I can give my idea that we, in the U.K., are perhaps in just a slightly different position. We have, so far at least, not built light water reactors and it would seem to me that the problem, at least in the terms that I was outlining to you, may well be a light water reactor problem. Whether it would be reflected to no matter what reactor type, I'm not quite sure, but I do agree that it is a problem which affects all of us.

VOLGENAU: I'll make one remark, if I may Mr. Chairman. With regard to the type of reactor, I don't think that the public would be subtle enough to distinguish between a light water reactor of one type or any other type of nuclear reactor. In the minds of the public, a nuclear reactor accident is an accident and frightens everyone.

GAUSDEN: Is there a general agreement on this?

COURVOISIER: Not at 100%, you may recall that we have had the first full scale loss of coolant accident in the world, happily in a cooled
reactor, where you never lose the coolant completely and under very fortunate circumstances in the Lucerne reactor, maybe you heard about it. The final report on what has happened in that reactor is in its last phase after eight years. The reactor was destroyed and mainly the element which caused the accident, or incident better to say because nobody was hurt, was so badly damaged that it took years and years to come up with a consistent and reasonable hypothesis on what the reason of that accident had been. There was no pressure to investigate, this is a line of reactors which was stopped, nobody is technically very much interested in it, so we didn't give it high priority. But recently we have come up with an intermediate report, hopefully the last one before the final report comes out, and we said purposefully that this is a special type of reactor and what did happen there, cannot happen in other reactors. This was very well received by the public and by the press.

GAUSDEN: Mr. Edwards

EDWARDS: I feel I have got an end to the discussion at the stage since you raised the question of the different reactor systems. Perhaps I can put the question to the panel whether or not they think that the regulatory boides have any part to play in making a choice between competing reactor systems for a specific country, or do they all adopted the posture that is up to somebody else to make the choice on grounds of economics and industrial capability and so on?. And whatever the choice is made, the regulatory authority will then impose its requirements on safety grounds?.

GRONOW: It is not only a question of economics of reactors that you have to consider. It is a question as to whether or not the problems that waste arises in that reactor and the environmental effects are worse
than any other reactor system. And if you compound the problem, that
is to take account of the wastes arisen, the reactor safety problems,
and the economic costs of making reactor systems to an acceptable level.

COURVOISIER: I can tell you from all the experience, that the utilities
in my country submitted at least two different safety reports on two
requests for construction permits of reactors of different types; In one
case including a HTR, another BWR and PWR; and to a certain extent they
hope that we would solve this thorny problem of making a choice for them.
Officially we refrain from doing this and did two evaluations and assess-
ments and handed the hot potato back to them. There would have been a
very difficult situation if we had influenced that choice and, as it was,
we didn't had a reason to. If you compare reactor systems, you will
always find that one system has certain advantages and another one has
other advantages. At the time when we discussed our first reactors some
of the points of view, which Mr. Gronow has just mentioned, were not on
the priority list. These days we would have quite hurry upon the priority
list, with the possibility of dismantling the reactors again. But I'll
come back to the question of the Chairman. We refrained from influencing
this choice, because the consequences might have been too extreme as we
refrain always from telling the operator how he should design this and
that. Outside the hall we may ask him "did you have a look into this or
that possibility", but only as very timid suggestion, I might say. We
never go further down. It's too touchy for an authority to take a strong
position.

DOPCHIE: Well, Mr. Chairman, I believe one should first define who has
authority. Does the authority end with the Chief of the State? In the
U.S., for what I understand to be safety reasons, they have prohibited a
reactor type, the fast reactor; not because of the danger at the sites
themselves, but for the danger throughout the world. So, I believe that
the answers that have been given on this problem are only taking into
account the people we are, as being the authority, and forgetting that
the main thing we are doing is to report to a higher authority. And in the case of the U.S. it was, I believe, the President of the country the one who decided it so.

BUERGO: Mr. Chairman, I should like to make a comment on one point that I believe we have not handled and is preoccupying all the regulatory bodies. It is of the same nature that the problem that we already handled, in a certain manner, in relation to the reactor vessel in the old power stations. It is a problem of backfitting related to the fuel. We talked about construction, siteing, manufacturing components, start up, operation and fuel, but the fuel is not leaving the power stations or is not going to leave according to the rules foreseen due to the political problems in the world. Then, we are envisaging that we have to change the philosophy of the power stations, in the sense that the storage ponds for spent fuel be converted into bigger storage than foreseen. It is the rule that the storage pond be always ready to receive the whole core charge so that, in case of an incident, it can be unloaded and be able to make the repairs or whatever it is. Nevertheless, the storage ponds are being filled and also one can foresee the possibility to increase the storage capacity and I believe this is changing the existing philosophy from the point of view of safety, not only the increase of elements in the ponds, but the accumulation of fission products of all this fuel. This is a matter on which we are worried and we do not know if decisions have been taken, which is the policy being followed and the existing criteria. I'll be very glad to hear any comment and I believe it would be a benefit for all of us.

GAUSDEN: Is there anyone on the stage who wants to extend on this problem?

COURVOISIER: I can only underline what has been said. This is a difficult problem. The utilities try to fill the pools more and more and
you could envisage, maybe it's physical impossible but you envisaged the situation where the pool becomes the primary source of danger on a site. Until now, we have considered the nuclear steam supply system to be the main source of danger on the site. Some development of the situation which I just outlined is acceptable, but where is the point when we say "now no further". We don't know yet, we are right now in my country, because of the requests, going somewhat more in detail, but I don't like we hold tendency and we know where the tendency comes from, and the impossibility or near impossibility to get rid of the fuel in useful time, but I foresee a situation where we will have to tell the utility "your pool is full or nearly so that you can just add what you have still in your reactor, you have to stop the operation".

GRONOW: I would just talk about another point, about backfitting, and that is in the context of requests made by regulatory bodies for backfitting in power plants. The difficulty I found, was that we have all discussed the fact that the licensee is responsible for safety, and there is no doubt that in all member states this is a very critical statement. But if one now makes requests of backfitting because of increasing safety standards, then is this removing the responsibility of the licensee on the hand?. If a simple direct request to improve safety standards by the addition or modification in some parts of the plant is giving, in explicit terms, directives in contrast with the requirement that the licensee is responsible for safety, one of the things that I think ought to be examined is this issue of safety standard stimulation of backfitting and, in the context of the licensee, his responsibility to ensure safety of the public at all times.

GAUSDEN: Do you wish to take this point?
BEAR: Thank you, for the sake of the discussion. I would like to challenge the statement or at least open it to some examination whether in fact, the licensee is only responsible for safety. I'm wondering whether this is the point of view held by anybody except beside the regulatory body itself. In other industries there are examples of failures that have occurred and part of the reactions of the owner of that facility were approved by regulatory body. There is recently in Canada a case in which much contamination of a large area by residues of uranium milling operation was found in the town. The contamination was turned up in another part of the country and it is quite obvious, from the results of the public reaction and the political reaction to the discovering of this contamination, that the regulatory body is being held responsible for not doing a good enough job of regulating the handling of those tailings. So, I'm wondering whether in fact the regulatory body does carry quite a large part of the responsibility for safety.

GAUSDEN: Mr. Gronow wants to respond.

GRONOW: I would like to prove, as an example, that in the past there have been many serious disasters in mines in some countries. And those countries have mine inspectors to set up regulations which are very stringent. But under no circumstances, when the mine disasters occur, I think that the mine inspectors can be made responsible for the disasters. But there is no legal, or if you like, criminal responsibility that catches those kinds of aspects. I think a difference must be made between criminal and civil responsibility on those aspects of inspection on regulations.

GAUSDEN: I think I can now show that there are different opinions even in the U.K., because I don't entirely agree with Mr. Gronow on this point. I think what he says is correct, as far as it goes, but only if the regulatory body can show that it has done everything possible, in the state of the knowledge available at the time that the regulation was made.
VOLGENAU: I like to add something to both comments. First of all, we have had similar problems with licensees who had gone out of business, the site was examined and the licence was terminated and the licensee was allowed to get rid of the property, and then subsequently radiation was discovered. In these cases the government, which includes more than just the regulatory body, is taking up the responsibility for cleaning up the sites because they absolved the licensee of his responsibility. But there are many more cases. Some of them hardly pending in the U.S. in which the licensee is about to go out of business and he has applied to have his licence terminated. Then, we conducted an evaluation including an on-site inspection and we found problems and we will not allow the licensee to get out of his responsibility until the site is cleared up to our satisfaction. So, I feel that the precedent is fairly well established in the U.S. and in fact there is not a contradiction in terms of responsibility for the licensee.

SERVANT: Je voudrais faire deux remarques. La première n'a pas de caractère publicitaire mais comme on a fait allusion aux difficultés de stockage des combustibles irradiés, je voudrais quand-même rappeler la politique française dans ce domaine qui consiste à penser qu'une partie de ce problème se resout en retraitant ce combustible, ce qui a pour avantage de réduire très sensiblement le volume des produits dangereux, des produits de fission à stocker. Ma deuxième remarque tendrait à revenir sur l'exposé de Mr. Courvoisier, qui, à très juste titre souligne les aspects humains qui nous préoccupent, mais qui a peut-être sur tout insisté sur ces aspects humains qui concernent l'exploitant. Il me semble que nous n'avons peut-être pas suffisamment insisté sur l'aspect humain vu du coté de l'inspecteur, je dirais l'inspecteur dans le sens strict, c'est-à-dire, la personne qui se rend sur le site, qui visite les installations. Nous avons fait allusion aux problèmes de responsabilité, certes,
nous avons fait allusion aux problèmes de sa compétence dont nous avons
reconnu qu'elle ne peut-être universelle, ce qui pose certains problèmes,
mais il me semble que nous n'avons pas suffisamment évoqué le problème,
l'équilibre de sa fonction, de sa mission, et nous avons relevé à l'occa-
sion que beaucoup d'inspecteurs en dehors des visites d'installations ils
ont d'autres tâches et nous nous demandons, en France en particulier au
moment où nous renforçons notre système d'inspection, si la notion
d'inspecteur à temps plein, c'est-à-dire, d'un agent qui passe son temps
à visiter des installations, à faire des rapports, est une notion tout à
fait satisfaisante et s'il ne convient pas que la mission d'inspection
proprement dite soit combinée avec d'autres missions, par exemple relatives
au licensing, évaluation ou d'autre tâches de ce genre. Nous nous ne
contentons pas de constater que la nécessité nous oblige dans la plus
part des cas à confier aux inspecteurs d'autres tâches, mais nous nous
demandons si ce n'est pas un élément équilibrant, disons satisfaisant,
pour définir le profil de la fonction de cet inspecteur. Je pense que
sur ce point il serait peut-être intéressant qu'une enquête de l'OCDE
tend à comparer ce que peuvent être les profiles des fonctions des ins-
pecteurs dans différents pays.

GAUSDEN: I am sorry, I must do the discussion to be close. I did say
when we came back that this would be approximately at 5.30 p.m. and that
time has in fact come. I would just for one moment take up the time of
the meeting, from the personal point of view perhaps, to say that I have
found this meeting extremely useful and interesting and as the first
meeting, if you like, the First Specialist Meeting sponsored by the Sub-
committee on Licensing of CSNI, I think this has proved a very valid
thing. I cannot close, of course, without assuring on everyone's behalf
saying how grateful we are for the facilities we have had here, and of
course, for the interpreters who have done a magnificent job, and I will
thank everyone concerned with the arrangements for the success of this meeting. I declare this particular discussion closed and I hand over to the meeting chairman Dr. Alonso.
CLOSING REMARKS
BY
A. ALONSO, CHAIRMAN OF THE MEETING

Mr. Vicepresident and JEN's Director General, distinguished representatives from the different countries and international organizations, ladies and gentlemen. We have come to the end of our meeting and it is time for me to deliver my concluding remarks. The high caliber of the papers presented and the interest of the discussions maintained makes my task difficult; nevertheless, the effort and dedication of the Chairmen and Scientific Secretaries of the different Sessions; the extra work, attention and help from the members of my own staff, and specially the abilities, experience and knowledge of the Chairman and Scientific Secretary of the Final Panel have made it possible for me to be able to present to you some concluding remarks which, I hope, may have some sense. I will present them one by one, under the provision that the order does not represent any priority. I have reached ten conclusions some of them leading to possible suggestions for the CSNI.

1st. The report by Messrs. Gronow and Ilari, prepared as a mandate from the Subcommittee on Licensing, has produced numerous points of discussion and has generated, and I am sure it will go on generating, a lot of ideas. We must first recognize with Mr. Servant, the Chairman of the I Session, that there are some gaps in the information received,
my thinking being that these gaps should be completed. Therefore, it is my suggestion, taken from Mr. Gronow and clarified later by Mr. Stadie, that the exercise should continue in the future by completing the questionnaire and by defining with precision the meaning of each response in the sense that Mr. Gronow has suggested during the discussions. In that contest, there could also be included the problem of the inspectors' responsibilities, as suggested by Mr. Courvoisier in the final panel.

2nd. There has been an important matter which has not been discussed completely and that is the basic philosophy behind the organizations from the different Licensing Bodies. The main lines followed by these bodies respond naturally to the basic administrative structure of the different countries so that it will be difficult to implement basic changes in the existing organizations. Nevertheless, it seems to me that, on principle, it will be effective to have, within the same organization, the authority to take decisions, the knowledge to take sound and sensible decisions and the source of this knowledge, which rest within the research and development activities. Nevertheless, so centralized a system may find difficulties in countries with decentralized administrative arrangements. Therefore I am proposing, also following Mr. Gronow's presentation, that the effectiveness of the different types of organizational philosophies should be analyzed within the Sub-committee on Licensing, perhaps by incorporating the relevant information on the questionnaire. I will also include here Mr.

.../...
Gronow's suggestion that CSNI should maintain a Working Group on the interchange of inspection practices what, I believe, is en essence the aim behind Mr. Perello's proposal.

3rd. There has been some concern among a few countries on the quantity and quality of the inspection staff. Mr. Eckered mentioned that in relation to the situation in Sweden and in Spain and Mr. Curvoisier was also preoccupied by the matter. The idea has been expressed that a small number of regulatory inspectors can be compensated by a larger number of inspectors in the utilities, manufacturers and vendors. Everybody would agree that nuclear safety in nuclear power plants is implemented first within the designer, continues with the manufacturer and is checked by the utilities, so there could be a tendency within some of the above mentioned bodies to think that regulatory inspection is not necessary, even doubts have been expressed on the use of independent consultants. Of course, very few of us would conclude that regulatory inspection is not necessary and most of us would probably think that having a limited or a non well trained inspection staff is very closed to having no staff at all. For this reason, let me suggest, to help each other, that within our Subcommittee on Licensing we share views on how to cope with this problem - and on how the countries in need can gain from the inspectors training programs established in the most advanced countries.

4th. The Conference has tried to analyze the meaning of inspection in comparison with that of review and assessment.
Mr. Dabek put first the question which was analyzed by Mr. Grier. We have not been able to find the border line between these two activities and perhaps the reason is that there is not such a border line, even though it can be artificially established in the organizational charts. It is clear that licensing can be defined as the optimal action of inspection and assessment with the aim of assuring safety and radiological protection. So it seems to me natural to propose to the Subcommittee on Licensing that a specialist meeting should soon be conducted on Regulatory Review and Assessment.

5th. Our Conference has touched only slightly on pure technical matters and has concentrated itself on more administrative arrangements. This is natural, being ours the first Conference of its type celebrated under the mandate from the Subcommittee on Licensing. It seems that this importance we are giving to administrative matters will continue to be the case if the Subcommittee accepts the meeting being proposed in the point above. But I consider that these two meetings - the one we are now closing and the one I am proposing - could prepare the way towards more technical meetings on inspection and assessment techniques. It should probably be so, as we can not forget that our Subcommittee is a daughter of CSNI which, dealing mainly with research, should be considered as the source of our knowledge; therefore, these future technical meetings should be considered as a needed link between the parent committee and its daughter.

.../...
6th. Some concern has been expressed by the different representatives, mainly Messrs. Servant, Grier, Eckered and Courvoisier on the relative importance which is being given to mechanical components - specially pressure vessels - in relation to electrical components, civil areas, fuel elements and radiological protection instruments and practices. There are of course reasons for these differences and a closer analysis of the situation leads one to conclude that this differences may not be so big. A concern has also been expressed by Mr. Dopchie on the correct application of quality assurance. One may think that from time to time we forget that nuclear technology is, in reality, conventional technology with a touch of nuclear science; this touch can, of course, be very profound, as in the matters related to nuclear fuel and radiological protection. We cannot expect a rapid rationalization of completely new technologies, but we can expect a rapid adaptation of the old codes on pressure vessels to the presence of radiation and more stringent quality requirements. It seems then clear that internationally applicable standards are very necessary and I want to express that we join efforts with NEA, as Mr. Stadie mentioned in his openings remarks, in the support of the international Atomic Energy Agency's Standards Program, in the way Mr. Dabek delineated for us.

7th. There have been many points of interest discussed deeply: the resident vs. non resident inspector philosophy; the importance of triplicate, as in Germany, vs. independent -
inspections, as in other countries; the relations between the inspectors and the licensees; the authority and responsibility of inspectors in discharging their functions, concern mainly expressed by Mr. Courvoisier; the purpose of Safety Committees, brought about by Mr. Calori; the problems related to the transportation of nuclear fuels, discussed - by Mr. Volgeneau during the last session; human errors and many other subjects. I am sure we will all meditate on them for our advantage.

8th. There have also been a few points not completely or insufficiently discussed. A significant example is the inspection of the site itself before construction and the acquisition of site related parameters. On a global aspect, I personally would like to mention the specific inspection problems inherent to those countries which do not develop reactors, and have no important research programs, but rely on important nuclear power programs based on plants of different types and suppliers bought in the international market. I hope these problems are clearly identify and included in future meetings.

9th. In a meeting like this it is nowadays difficult to avoid talking on public information, public participation in the licensing process and public acceptance of nuclear -
energy. This problem has been discussed in an intelligent way. It seems that public information and public involvement could be a solution to public acceptance. There is no question that well intentioned people will be convinced of the safe operation of nuclear power plants if they have the facts. To this respect the integrity, morality and knowledge of the inspectorate body could have a major influence. Mr. Volgenau has been very specific in this respect recommending us to continue the interchange of information on these matters within the Subcommittee on Licensing.

10th. My final point is the easiest to formulate. It is my internal hope that we have made your stay among us profitable and pleasant in every respect, so that you would remember, for a long time, the Madrid meeting on Regulatory Inspection both in your work and in your private lives. Thank you very much for your attention.
ORGANIZATION FOR ECONOMIC CO-OPERATION AND DEVELOPMENT

NUCLEAR ENERGY AGENCY

COMMITTEE ON THE SAFETY OF NUCLEAR INSTALLATIONS

Sub-Committee on Licensing

SPECIALIST'S MEETING ON

REGULATORY INSPECTION PRACTICES IN NUCLEAR POWER PLANTS

Madrid, Spain, 27-29 September 1977
Hosted by the Junta de Energía Nuclear, Spain

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Dated 26 September 1977
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