RESEARCH AND THE REGULATORY REVIEW

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To enable the regulatory review to be effectively undertaken by the regulatory body, there is a need for it to have ready access to information generated by research activities. Certain advantages have been seen to be gained by the regulatory body itself directly allocating and controlling some portion of these activities. The principal reasons for reaching this conclusion are summarised and a brief description of the Inspectorates directly sponsored programme outlined.

Afin que l'organisation régulatrice puisse se charger effectivement de la revue régulatrice, il faut que celui-là ait accès auprès des informations produites par les activités de recherche.

On a remarqué que certains avantages ont été gagnés par l'allocation et le contrôle directs de quelque partie de telles activités par l'organisation régulatrice.

Il y a un resumé ici-bas des raisons principaux pour lesquels on est parvenu à cette conclusion, ainsi qu'un court sommaire du programme de l'Inspectorat qui est directement fondé.

1. Introduction

Any Corporate Body wishing to construct or operate a commercial nuclear installation in the United Kingdom is required by law to obtain a licence from the Health and Safety Executive (HSE) through HM Nuclear Installations Inspectorate as a constituent part of this body. The way in which this process operates has been described in a paper previously presented in Session II and it can be seen from that paper that the approval of the regulatory body is required before the applicant can proceed beyond certain stages in the construction, commissioning or operation of any plant.

These approvals will only be granted by the HSE after it has carried out thorough reviews of all those features of the plant considered pertinent to maintaining safety, and relevant to the stage of the licensing process reached.

This regulatory review frequently reveals the need for additional knowledge and understanding which does not form part of the designer's safety case. Useful information can be gained from previous experience but it is often the case that the information required can only be obtained from further purpose built tests or basic research.

Much of this kind of work will be undertaken by the manufacturer or operator or will be carried out by other industry related research and development bodies such as the United Kingdom Atomic Energy Authority.

Examples of research sponsored by this latter body are given in the next and complementary paper.

There is however a need for the direct allocation and control of this type of work by the regulatory body itself and this latter approach has been seen in the United Kingdom to have certain advantages. The main reasons for reaching this conclusion, an outline of the advantages to be gained, together with a brief summary of the Inspectorate's own programme are given in this paper.

2. Need for Research Activity Input

It can be seen that, in a period of rapidly advancing technology and in an industry where a high level of technology is commonplace, it is essential that the regulatory body should have ready access to up-to-date information upon which to base its safety standards and ensure that adequate margins to safety are maintained. This is especially true for those features of a plant's construction or operation where there is little previous practical experience to fall back upon. But it can also be true for those more prosaic areas where performance has been taken somewhat for granted.

In particular the regulatory body requires to have:-

(i) information and understanding in good time ahead of the actual design work to help in establishing the principles and standards which will be applicable to the assessment of the construction and subsequent

operation of new installations; and to set down the requirements for the safety case;

(ii) the earliest and fullest information concerning the safety and efficiency of existing types of installations so that any corrective actions or extension of controls or checks can be instituted quickly; and

(iii) independent sources of information upon which to base its own views.

Also the regulatory review will identify gaps in knowledge together with those areas of potential weakness or instability which may lead to hazardous situations. These gaps must be filled and the areas identified closely examined so that:-

(i) they can be shown ultimately not to be significant, either because of their intrinsic qualities or on account of the measures incorporated into the design; and hence be eliminated from further consideration;

or (ii) they can be shown to be sufficiently understood so that steps can be taken to bring about a modification to the construction or operational features of the plant so that the potential threat is eliminated or alternatively the consequences arising from a fault or failure can be contained.

hence the review can be completed.

To reach conclusions on these matters it is necessary to make judgements on complex and sometimes novel scientific and technical issues. Such judgements frequently reveal the need for further supporting information which is not currently available and which can only be acquired from research studies.

It can therefore be seen that one of the principal needs of the regulatory body is the promotion of such activities in the research field to enable the above duties to be carried out and a high standard of assessment to be maintained.

3. Advantages of direct control

The regulatory body could rely solely upon the results of research sponsored by the industry for carrying out its review but experience suggests that certain valuable benefits to be derived from a direct involvement in activities of this type would then be lost. These can be briefly outlined as follows:

Independence

In some cases judgements can only be made with confidence when supporting research is carried out on a truly independent basis. This can avoid potentially important decisions being based upon incomplete information; such a situation could arise using the results of industry based research which are frequently related to closely defined problems and are often

influenced by commercial pressures. It is therefore considered essential that the regulatory body has the complete freedom of operation which can only be obtained by having direct control of both the technical and financial aspects of this type of work where it is thought necessary.

Fundamental Understanding

It has been found that direct involvement in research by the staff of the Inspectorate permits them to become better informed in the pertinent topics and allows them to appreciate with more clarity the issues involved.

This in turn permits the staff to take further part in discussions with the industry and to offer criticism or advice with enhanced confidence and credibility. In addition the fact that data can be made available from such work is a powerful factor in influencing decisions and persuading the industry towards a particular course of action.

Flexibility

Programmes structured by the Inspectorate's staff can be more closely tailored to fit their specific requirements on any particular issue or alternatively programmes can be loosely defined, if needs be, and allowed to develop over a broad and flexible basis. In this way again a more complete understanding of the problems can be gained by the staff due to the respectively more detailed or wider context in which they can be viewed.

Safety Awareness

Research programmes sponsored by the industry will have a tendency to be directed towards solving those problems associated with the need to successfully complete a project and demonstrate its efficacy. By orientating some programmes in the opposite sense the regulatory body can introduce a further element into the assessment process, and thus heighten the level of safety awareness in the industry. Even the knowledge that the Inspectorate is mounting an investigation into some particular facet has been found to create an interest within industry in its own right.

This awareness especially if re-inforced by the production of data obtained from investigation which shows that a question still has not been satisfactorily answered can act as a catalyst. Hence further and larger programmes of research into a topic can result from the industry itself taking a further interest in the topic and sponsoring its own programmes.

Special Investigations

Investigations which would normally be considered by the industry as not being "cost effective" can be mounted if considered appropriate. These types of investigations can cover certain unusual or extreme operational situations which may have been overlooked or considered by the industry as being of such a remote possibility as to require little or no detailed examination.

The regulatory body may not always share this latter view particularly where it is felt that the extrapolation of results from normal or upset conditions cannot be considered as reliable or feasible.

Also sensitivity studies to identify these parameters which will prove to be of most significance to the maintenance of safety can be carried out at the discretion of the Inspectorate using specific expertise only available from outside. Pilot studies can also be mounted if thought necessary to investigate the feasibility or credibility of techniques or methods available for solution of a problem. These techniques or methods may have either been submitted by the industry in support of a case or rejected by them as impracticable propositions.

Increased Resources

Work can be placed where a high level of expertise and competence in a specific topic exists and this enables information, facilities and resources not available within the HSE to be called upon. Familiarity with the factors of importance specific to the nuclear context may not exist in these groups but a learning process can be initiated and this in turn can create centres of excellence which can hence become more useful as further sources of independent advice and information.

4. Organisation and types of Research

Ideally it might be expected that the regulatory body should have its own research staff to conduct all the work thought necessary. However this can in many cases and certainly in the case of the Inspectorate be seen to be impracticable because of the wide range of expertise and facilities required, the limits placed on resources, and the under-utilisation of some forms of expertise which would result. It is also undesirable for the regulatory body itself to carry the major part of the responsibility for research since this responsibility must clearly lie with the manufacturers although some will be independent in origin. While an area of overlap between research activities is inevitable, the research sponsored by the regulatory body should be essentially exploratory or fundamental in nature by virtue of the above and because its resources are limited. The programmes should be aimed generally at showing a question requires answering rather than of attempting to provide an answer. Large programmes involving a heavy on-going commitment of resources, expensive rigs and long lead times are considered to be the responsibility of the industry itself in order to support its safety case.

Moreover the motivation for such research stems as much from the needs of the regulatory body's own staff to support their work of enforcement, setting of standards, giving guidance and drafting regulations, as from the needs of the industry itself.

The arrangement employed in the UK is to have a number of Project Officers, drawn from the staff of the Nuclear Inspectorate, each of whom is intimately involved in the safety assessment process in their specialist areas, appointed to direct and control the running of one or more projects. The identification of the projects and their contents is done by the staff and submitted for approval by management, after some preliminary consultation with possible contractors. After consideration

by management of such factors as its importance, timeliness and cost, a project - if approved - is placed with the contractor where the expertise and resources are best thought available. This can include the Universities, independent research organisations, Government laboratories, or Government aided bodies like the United Kingdom Atomic Energy Authority. Independent consultants are also engaged in some cases and they can be involved intimately in the details of the project if thought appropriate. Projects are normally supported in the first instance for periods up to three years from budgets directly under the control of the Inspectorate.

5. Interagency Collaboration

A special area where more extensive commitments can be entered into is that where interagency and sometimes international collaboration can be shown to be appropriate and possible. Larger commitments on a shared basis can thus be entertained. There is a strong case for strengthening the existing interagency collaboration on safety research. This would require a recognition that the importance of safety, particularly as a matter of public re-assurance, is a question that merits co-ordination of effort, openness and sharing of results even if on an unequal basis. Duplication of effort can be avoided by this means and complementing of programmes can be arranged.

Examples of research where the kind of collaboration is possible are outlined in the following paper which illustrates some of the activities of the United Kingdom Atomic Energy Authority in this field. In such cases the Inspectorate may be represented on a number of research and development liaison committees to which it can introduce proposals and obtain access to results.

Further examples are to be found in the involvement by the Inspectorate's staff in European Economic Community and OECD sponsored research activities. The programme of work carried out at ISPRA and that of the HALDEN project in Norway are illustrations of this.

6. Outline of the Nuclear Installations Inspectorate Research Programme

The programme of research sponsored directly by the Nuclear Inspectorate forms a part of the overall research programme mounted by the Health and Safety Executive. This programme is of a very broad scope and covers all the areas which come within the regime of the United Kingdom's Health and Safety at Work Act. The programme is published annually prior to its implementation in the form of a handbook[1]. Each proposed project is listed with brief details of the reason why the project is being carried out, together with an outline of the proposed work content, and its expected timescale and cost. The listing includes those projects carried out 'in-house' i.e. within the Health and Safety Executive's laboratories, but does not include a set of fringe projects, closely allied to research but of a more practical nature which are placed under the heading of 'Support and Testing'.

The total budget for all the Research and Support and Testing activities of the HSE amounts to over £8.5m. The Inspectorate's direct share of these resources enables it to sponsor over 50 individual projects, a number of which will be on a shared basis with other organisations.

The Inspectorates programme covers a wide range of topics in its own right which range from the examination of the purely radiological aspects of safety to the study and analysis of complex engineered systems and components found in reactor plants. Both theoretical and experimental studies are sponsored; the theoretical studies being followed up with experimental work when considered appropriate and where resources permit. An important feature of this work is that although some projects are specifically nuclear in context many have a more general application owing to the wide range of advanced technologies applied to the total system. A similar cross fertilisation can occur from other projects carried out under the direction of the other divisions within the Health and Safety Executive.

The results obtained from this type of work are incorporated in the assessment or review process and disseminated by reports, published articles and presentations at International Conferences. Significant results from the past years activities are also precised in a further yearly publication by Her Majesty's Stationery Office[2].

Results are also directly shared in some instances with other agencies so that further work in the topic can proceed and a more comprehensive investigation result.

A listing of the projects mounted by the Inspectorate in the last year is provided in Appendix 1 for reference.

Conclusions

There is a need for the regulatory body to be directly involved in research activities if it is to effectively fulfil its statutory obligations relevant to safety. The ability to directly allocate and control a portion of these research activities can be seen to be of significant benefit to the regulatory body.

The type of research activities engaged in by the regulatory body should be confined to those which enable it to perform its statutory duties in an effective manner. Large scale programmes should be left for the industry itself to sponsor.

There is a powerful case for more interagency collaboration in this area in order that resources can be pooled and the information relevant to safety thereby increased.

References

1. Health and Safety Executive Research Programme - Research Planning Group, Health and Safety Executive, London.

2. Health and Safety Research 1976 et seq. Her Majesty's Stationery Office, London.

Appendix 1

Titles of projects directly sponsored by the Inspectorate in 1978 (excluding projects listed under Supported Testing).

Development of Forensic Techniques for Examining Corrosion and Oxidation Processes

The Effect of Combined Mechanical and Chemical Action on the Service Life of Nuclear Reactor Components

Effect of Chloride Contamination on Performance of Stainless Steel Components in AGR Environments

Avoiding HAZ Hydrogen Cracking in C-Mn Steels with Lean Alloy Additions

Significance of Arrested Short and Brittle Cracks in Fracture Toughness Testing of Weldments

The Role of Prediction in Establishing Siting Criteria

Thermal Explosions of Potential Significance to Nuclear Reactors

Fuel Pin Modelling Studies

Fast Reactor Whole-core Accidence Explosion Yield

Fatigue Crack Growth in CFR Materials

Liner/Concrete Interface Studies at High Temperatures

Core Configurations for a Low Sodium Void Reactivity Coefficient

Study of Energy Dissipation Structures

Non-destructive Examination of Fatigue Cracks in Austenitic Material under Sodium

Corrosion and Materials Properties of Steels in Sodium

Behaviour of Radioactive Isotopes in Sodium

Study of Fluid Dynamic Aspects of Energy Dissipation within the LMFBR Primary Vessel

High Temperature Sodium-concrete Interaction

Modelling of Reflood Heat Transfer

PWR LOCA/ECCS Refill Experiments

PWR Fuel Can Experiment (Flow Blockage)

Transient Dry-out and Flow Reversal

Upper Plenum Entrainment

Investigation of Computerised Methods of Event/Fault Tree Preparation

Transient Physics Studies

Pipe Whip, Analysis and Energy Absorption

Probabilistic Fracture Mechanics

Radiological Consequences of Advanced Reactor Systems

Fuel Behaviour

Toughness of Stainless Steel at Elevated Temperatures

Ultrasonic Detection and Measurement of Defects in A533B Steel

Stability of Cracks in Tough Materials

Time Dependent Behaviour Study of Pre-stressed Concrete Pressure Vessel