SUMMARY OF THE CURRENT UK POSITION ON DECOMMISSIONING SAFETY CASES AND CONTROL OF OPERATIONS

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Safety thinking in the nuclear safety field continues to evolve in the light of experience. This paper seeks to share this evolution with the process industries to engender an open interchange that may help everyone. The advent of the nuclear decommissioning authority (NDA) and the recommendations from other sources has led the Nuclear Installations Inspectorate to review its safety assessment principles (SAPs) and make them even more relevant to the operations we regulate.

This paper concentrates on some of the emerging thinking from decommissioning which also has relevance, at the conceptual level, for other nuclear and high hazard, non nuclear operations.

The nuclear goal setting regulatory regime is flexible enough to cope with this although there are still significant uncertainties. The guidance in SAPs is a sound basis on which to build. It is more the balance of arguments, their complexity and how the resulting safety reliances change. However, there are still areas where further development is needed and the paper outlines how this thinking needs to evolve.

BACKGROUND AND INTRODUCTION

UK Government policy is laid down in the White Paper on radioactive waste management policy [14], and states: "*The Government believes that, in general, the process of decommissioning nuclear plants should be undertaken as soon as it is reasonably practicable to do so, taking account of all relevant factors. In future it will ask all nuclear operators to draw up strategies for decommissioning their redundant plant. These will need to include justification of the timetables proposed and demonstration of the adequacy of the financial provision being made to implement the strategies.*"

This drives the overall strategy for decommissioning and its associated licensing regime requiring a safety case. In the nuclear regulatory regime, the Health and Safety Executive's (HSE) Nuclear Installations Inspectorate (NII) does not specify what should and should not be in a safety case [12]. However, the regulatory goals have been set out in our Safety Assessment Principles (SAPs) [1]. These Principles were originally written for nuclear plant in design and they are also used to inform periodic safety case reviews required under licence conditions.

We have decided, in the light of the experience gained over the last decade or so to review our Principles against the conditions in the industry we regulate. It is important to note that the initial reviews show that most of the original Principles are still relevant but could be made clearer in their application to the wide variety of plant we regulate. The main omissions were in the areas of safety cases, decommissioning and radioactive waste management. We had already identified this in our subsidiary guidance [e.g. 9,10]. In addition, we see alignment with the IAEA guidance as fundamental to this review and we are amending our SAPs to reflect this in a manner consistent with UK nuclear safety legislation.

This paper is based on the premise that the current Principles are largely adequate with informed interpretation. The added clarity of the revisions and additions should allow our stakeholders to better understand what their regulator expects and how they can comply with the relevant parts of their licences.

STRUCTURE OF THE TECHNICAL PRINCIPLES

NII's Principles cover many aspects of nuclear safety including such things as siting, human factors, management systems and emergency planning. However, for the sake of clarity, this paper considers what might be called the "technical Principles". These are primarily the engineering and fault analysis Principles that guide NII's safety case assessment process.

The most relevant current SAPs are those dealing with:

(a) Deterministic Safety Analysis (DSA)
(b) Severe Accident analysis (SAA)
(c) Probabilistic Safety Assessment (PSA, often known as QRA – quantified risk assessment)
(d) Good Engineering Practice
(e) Waste Management

These all represent objectives and are part of good practice for both design and operations.

It is important to note that Principles were intended to guide inspectors in assessing plants in design. However, they are also used in judging the safety cases for existing plants taking into account what may prove reasonably practical. In this, the important concept of the Modern Standard is used to make judgements [2,3,4].

Taking each of the aspects in turn:

DSA

The SAPs actually uses the term "design basis accident analysis" often termed DBA or DBAA. However, the term DBA(A) has a number of meanings depending on where in the industry it is used and so this alternative has been coined to try and avoid such confusion. DSA is also a slightly wider concept since it explicitly includes the engineering aspects in an integrated way.

DBA and thus DSA, is defined in the SAPs as a robust demonstration of fault tolerance. This allows us to explore the underpinning ideas to incorporate such analyses into safety cases. Further, the aim in the analysis is also to demonstrate that the inherently safer options have been considered first. HSE has used a number of ways of encoding this. The approach to this in the SAPs is known colloquially as the P61/P62 Hierarchy, after the two principles, 61 and 62, where this originates. P61 says, in essence, that faults should be avoided by safe passive means if possible. P62 says that the sensitivity to faults should be minimised. This has been a major driver in seeking inherently safer storage for high-level liquid waste at Sellafield [5] where mobile self-heating Highly Active Liquor is converted to glass which needs virtually no active systems to ensure its safety.

The first point to be drawn out is that DSA is concerned with faults which may be considered as transients or departures from normal operation. This analysis does not consider all faults but only those which might credibly be foreseen in a plant lifetime. This analysis defines the limits of normal operations – referred to as the safe operating envelope – and so any deviation beyond this can be defined as a fault. For example to ensure robustness, the worst permitted plant states are assumed. This analysis can then be reflected back into the permitted maintenance states to ensure the continued validity of the analysis. To minimise vulnerability to faults in these permitted states SAPs call for best use of segregation, diversity and redundancy and for tolerance to any single failure in safety systems in a manner proportionate to the hazard. Overall, this should result in a plant with high reliability safety systems. The deterministic method's main weakness is that it deals with single faults or groups of faults without taking into account other, possibly related scenarios.

The convention in DSA is, in order to further ensure robustness, that any uncertainty in the analysis is allowed for by proportionate conservatism. This conservatism is judged both on the uncertainty in the underpinning data and on the magnitude of the hazard being considered. This is one concept that does need to be very clear. Hazard is defined as the potential to do harm and is a function of inventory, toxicity, radiation levels, "driving force" and mobility. Hazard (or hazard potential) is a function of the inherent properties of the material being considered. For example, it is the ability of Highly Active Liquor to boil to dryness in the absence of cooling and thus potentially give high doses that makes this a high hazard material. In general, the higher the hazard, the greater the rigour and conservatism expected in the analysis.

This form of analysis needs information similar to (or related to) that used for design. In order to generate proportionate confidence there needs to be a judgement both on the magnitude of the hazard and the reliance, or safety significance, of that analysis. The greater the reliance and the higher the hazard, the greater the rigour required. To offset concerns here, it may well be that operators are prepared to accept an operating constraint on a plant to keep the analysis simple and rigorous. This is a balance that needs to be struck on a case-by-case basis depending on the amount the operator is prepared to spend to gain the benefit from reducing margins due to analysis conservatisms. Plainly, if a novel and/or untried technique is presented for a high hazard operation, then the case will receive particular scrutiny particularly if high reliance is placed upon it.

There is a preference in DSA for the conservatism to be in the analysis as opposed to building it into specific engineering margins. This allows the analysis conservatism to permeate right across the engineering and hence to the operation of the plant and makes the case more robust as a result. However, it is always possible to balance out the analysis conservatisms and the engineering margins to give a suitably robust design that can be operated safely, economically and in an environmentally friendly manner.

Conversely, it is possible to deliberately introduce factors of safety into the engineering itself. This is particularly relevant to mechanical design for vessels and mechanical handling equipment. However, since that factor of safety will only apply to individual plant item (or items) it will not necessarily permeate through the entire operation under consideration.

DSA is the bedrock of safety analysis. In combination with the engineering, it should deliver a sound fault-tolerant design. The resulting safety case will have inputs from both the analysts, the engineers and often operators, particularly in fault identification activities such as HAZOP, to form a "joined-up case". Such a case will be consistent and should allow the engineering to deliver in a cost-effective and proportionate manner. It is carried out throughout design and finalised when the design is frozen.

Experience shows that plants which meet the deterministic Principles generally do not have great difficulty in meeting the numeric or probabilistic Principles. However, because the probabilistic analysis is structured to look across the entire operation, there may well be reasonably practical improvements stemming from that analysis that could have safety benefit at reasonable cost. This is complementary to the deterministic analysis.

SAA

A severe accident is one which although only a remote possibility, nevertheless has the potential for high doses or environmental damage and so warrants further attention. It is not necessary for this potential to be realised. The prime difference between DSA and SA analysis is in the way that data is used. SA analysis is based on best estimates and as such may well be bounded by the DSA if the level of conservatism is high. However, a sound understanding of the underlying phenomena during such accidents avoids the need for introducing unnecessary conservatism and hence unfruitful expenditure. The main aims of SAA is to provide an input to emergency planning and to identify reasonably practical design improvements that can be implemented at reasonable cost. The outcome of this work should drive accident management strategies and their underpinning to make them useful to operators. This analysis is usually carried out as an extension of the deterministic analysis and develops with it.

PSA (QRA)

This is usually carried out using event and fault trees. However, analysis of this type is more than just the sum of a set of fault trees prepared to support reliability assessments for deterministic analysis, but rather is a global analysis of the plant covering the entirety of its operation. The strength of PSA is that it can model subtle interdependencies and demonstrate no undue reliance on any safety system or design feature. This allows a judgement about the balance of risk across faults or fault groups. It also allows an estimate for comparison with risk targets. The numbers from PSA are extremely useful when used in a comparative sense but are not usually of sufficient quality to allow an entire safety case to be based upon them in isolation. This is particularly the case when these numbers are very low. Because the analysis is highly dependent on the detail of the design the complete analysis tends to be late in the design life. However, it is plainly sensible to keep such analysis living to avoid late, costly changes.

There are other facets of PSA, besides risk numbers, that are also important e.g. minimal cut sets, importance analysis, and use of sensitivity analysis. There are also difficulties using risk targets for situations where the operation is about reducing risks – what criteria can be used? Engineering judgement is usually a better guide.

Good engineering practice

Irrespective of the outcomes of any probabilistic analysis, there is a standard below which any operation should not fall. This is often incorporated into company standards which give guidance on what the engineering should deliver in addition to other constraints placed on it. These, in turn, may well reference, or point, to national and international engineering codes such as the ASME or ISO series.

Incorporated within this idea is an important concept – the modern standard. The idea is similar to Good Practice where the modern standard would be "what would the plant look like if it were designed today". Thus, the modern standard reflects not only changes in the published engineering standards but changes in safety and engineering thinking, such as process intensification, as well as the experience gained in designing and operating similar plant and unit operations in house and throughout the world. An openness to modern standards should engender continuous improvement in the organisation and a sound, self-critical safety culture.

Today, the modern standard concept is not only used in new designs but also in Periodic Reviews, including those that cover decommissioning, that are required under UK Licence Conditions. These reviews need a clear view of the modern standard, identification of the possible improvements required to meet it and consideration of whether these are reasonably practicable.

Sound engineering is the basis for a well engineered, safe plant. This involves iterating with the fault analysis and waste minimization drivers to deliver a plant with suitable margins without excessive over design.

Waste management

This area of assessment is subject not only to all the other constraints but also:

(a) Further deterministic concepts such as the fundamental principles of inherent and passive safety and waste minimisation.
(b) Environmental policy and discharge authorisations also regulated by the Environment Agency (EA) (or the Scottish Environmental Protection Agency (SEPA) in Scotland) under specific legislation.

These represent further objectives which can constrain what may be reasonably practicable and is a very significant factor in decommissioning. In this, the NII has to interface with the EAs to implement government policy for joined up regulation. All the regulatory bodies concerned are actively pursuing better working practices in this regard.

Summary
Whilst it is convenient to separate out the various aspects of technical safety assessment as discussed here, the reality is that each aspect informs and interacts with the others. Each aspect has particular strengths and weaknesses; it is only by employing all these tools in a proportionate and appropriate manner that there can be high confidence that the plant engineering and operation will deliver an appropriate level of safety. Thus, not only must the safety case be adequate, but also the plant and safety case must correspond to one another (otherwise the case is inadequate). Such a safety case can then also be used by plant operators and safety inspectors.

SAPs, APPLICATION TO DECOMMISSIONING

Because of the UK's non-prescriptive safety regime, safety cases do not have to conform to a formula or recipe [12]. Conversely, it is plainly much more efficient and effective for both parties to have a mutual understanding about what a safety case should look like when it's right. This does not mean that every case must involve all the above aspects. In decommissioning, the balance of arguments is expected to swing towards a pragmatic approach that depends more heavily on professional judgement and strong operational control (often because of deficiencies in the input data to any analysis) [7].

Because timescales are necessarily relatively long, we expect facilities awaiting decommissioning to continue to be operated in a safe manner until they are ready for final demolition and disposal and the land remediated. Typical steps might look like:

(a) Ensure the current quiescent state has risks controlled to as low as reasonably practicable.
(b) Prepare the facility for removing the hazard
(c) Ensure downstream plant availability for processing wastes to a suitable standard
(d) Retrieve and process wastes
(e) Demolish, dispose and remediate the land

This is consistent with Government policy [8].

Some of these steps may happen concurrently and hence there needs to be planning to ensure that the various activities do not interfere with each other. Each step should have an appropriate safety case and, for a sizeable job, may need to adopt a staged approach with appropriate hold points. During this process it is accepted that there may be a temporary increase in risk to achieve the long term benefit.

Thus the balance of arguments in a decommissioning safety case will change from that used for operationally focussed cases. We already have some indications what such safety cases might look like – particularly when dealing with non power reactor facilities.

DECOMMISSIONING SAFETY CASES

Notable aspects of decommissioning safety cases that differ from the traditional operational approach include:

(a) Use of multi legged arguments
(b) Greater reliance on operator control/intervention
(c) Systems, structures and components designed for limited life.

Multi legged cases

SAPs at Principles 70 and 71 make allowance for "special cases":

> *"P70: Where a structure, system or component forms a principal means of ensuring nuclear safety and it is not practicable to demonstrate that the accident frequency principles P42 to P46 are satisfied in the event of its failure, the plant may only be accepted after the application of a special case procedure agreed as an alternative demonstration. The procedure should include a comprehensive examination of all the relevant scientific and technical issues, taking account as appropriate of precedents set under comparable circumstances in the past.*
>
> *P71: Where the special case procedure is applied or where any safety system is required to achieve a high reliability, an independent assessment of the item should be carried out in addition to the checking provided as part of the design process. The object of the assessment should be to confirm the adequacy of design specification and that the manufacture, construction and commissioning satisfies that specification."*

These Principles have their roots in structural integrity and so need interpretation before they may be applied more widely. In the decommissioning environment, application of P70 and P71 leads to the following restatement:

Where it is not possible to make a safety case that meets the usual regulatory expectation, then it may be possible to invoke a special case process that has the following characteristics:

(a) the case should take account of the best available sources of technical information;
(b) the case should take account of past precedents in similar circumstances;
(c) the case must show that account has been taken of best practice;
(d) the case must be subject to strong independent scrutiny;
(e) the method of demonstration should be agreed with the regulator beforehand;
(f) the case should be reviewed in depth, once sufficient data has been obtained, to demonstrate the case remains suitably conservative in the light of early experience;
(g) the case should identify safety systems that have equivalent, proportionate reliability to those that would normally be in place if the special case process was not being invoked.

The intent is to ensure that as much underpinning technical information as possible has been gleaned and analysed in an appropriate manner. The use of such a process or procedure is explicitly covered in the Introduction to the existing SAPs and embodied in Principles 70 and 71:

> *"In summary, therefore, the revised SAPs are intended to cater for non-standard as well as the standard approach. In no case, however, should this flexibility be seen as a means of bypassing the rigours of the assessment process; special cases receive particularly close scrutiny."*

This will not change. Thus, such cases will call for both expert resources on behalf of our licensees and in the Inspectorate. This has already been recognised [7]. Our experience shows that the biggest single lesson is one of early engagement between regulators and licensees. Increasingly this is being more globally recognised as a key characteristic of decommissioning.

Operator control/intervention

There are often significant unknowns when dealing with old plant that was not constructed or operated in line with modern practice. Equally, there are frequently significant uncertainties in the chemical composition and physical state of the contents of such facilities. In addition, many of the structures themselves are not to modern standards and so there is an ongoing imperative to remove the hazard. This imperative can sometimes mean that the safest reasonably practicable option for decommissioning requires significant reliance to be placed on the operators.

Such a strategy appears to run contrary to the DSA approach, which calls for passive or engineered safety systems in preference to human intervention. In consequence the safety case needs to adopt a pragmatic approach to minimise human error yet take advantage of the self-correcting feedback inherent in people-based systems (which machines have more difficulty in delivering).

Therefore, what is expected is a cautious, gradual, considered increase in commissioning and operation. This tends towards the command and control structure (reminiscent of a military approach) – e.g. personnel well briefed, a fall-back position that is well understood, recovery and disaster planning and a proactive management that is intimately involved at the workface. These features need to be referenced in the safety case and justified in the light of the potential hazard being considered. Adopting such an approach avoids "paralysis by analysis" [6] whilst facilities gradually deteriorate; overall the safety case needs to demonstrate a balance in favour of safety. However, balanced judgements of this type are far from easy and the precautionary principle [11] therefore needs to be invoked in a proportionate manner.

Although this approach is novel, there is nothing here which detracts from the applicability of SAPs. Instead, the circumstances of decommissioning require a revised balance in regulating such activities.

Systems, structures and components (SSC) designed with limited life

There is a heavy reliance on planning which should predict the limiting lifetime for SSCs. In many cases these can be needed for only a short part of the overall decommissioning. This begs the question "why design for a 20 or 40 year life?". This can promote the use of modular or reusable plant (subject to its suitability and the resultant doses). This concept is not new. The chemical industry have been doing this for years. In addition, the limited life aspect allows creative use of lighter components and commercially available alternatives from elsewhere in industry. The outcome can also be a reduction in waste from decommissioning the new facility itself. However, the expected life of the facility does need to be considered when adopting such an approach.

There is also the question "what does an engineered system look like in decommissioning?" In many cases it will not be necessary to have a fully installed system that is engineered once and for all. The important concept to bear in mind is that of the safety function which must be delivered – reliably and consistently. In decommissioning, with the limited functional life it can be possible to use portable or other non permanent safety systems **provided they can be shown to deliver their safety function reliably when required under all reasonably foreseeable conditions in their operating environment.**

This is also consistent with SAPs and builds on our experience over the years.

There are also other areas where there is still work to be done. These include:

(a) Dealing with time at risk and time based arguments
(b) Uncertainty in feedstock for processing and the resulting waste specifications.
(c) Streamlining the licensing processes
(d) Safety case control and consolidation

Time at risk

There are a number of well accepted algorithms for operational power reactors. What is less well covered is the ongoing degradation of SSCs which were not built to modern standards and for which few, if any, records remain. The main concern is the integrity of structures. Without inspection, it is close to impossible to make any judgement about the robustness of many structures – particularly if the environment is potentially corrosive. This is the situation for a number of the ageing chemical plants. In many cases inspection itself can be a fault initiator and may simply be impractical. Again, the precautionary principle needs to be invoked.

This comes particularly to the fore when considering external hazards such as seismic (and security – although that is not in our remit). In some cases the seismic fragility can dominate the risks from older facilities and drives strongly towards early and rapid hazard control. This makes it difficult to make balanced decisions about priorities since one driver may be a "real" hazard and another may be the uncertainty in structural performance. Getting this balance right is difficult. The inspectorate is currently developing tools to try and set a benchmark for our expectations but this is some way from maturity.

There is also the related aspect of balancing chronic doses to workers to avoid potential acute (accident) doses to members of the public. On old, contaminated plants with potentially high worker doses and an ageing infrastructure, such judgements are fraught with uncertainty and finding the correct balance is far from simple. This is particularly the case when the only reasonable way to carry out certain activities will be manually.

Our revised SAPs will address time at risk but the field is far from fully developed and we expect to develop this thinking further as experience grows.

Feedstock and waste specifications

Many of the plants in decommissioning at Sellafield have an inventory of waste that the licensee is unable to characterise well [e.g. 7]. In addition to making the safety analysis difficult and, often, highly conservative, it also puts certain other constraints on the safety case. These include:

(a) Justifying the engineering of a retrieval system that is tolerant of a wide range of materials – in composition, size and mechanical properties.
(b) Justifying the engineering for the conditioning or treatment plant to show that it will tolerate a similar range of materials.
(c) Ensuring that the treated waste is likely to meet the waste disposal specification(s). However, if there is an overriding safety reason to treat waste, we would expect such waste to be put into an inherently safer form – referred to as being passively safer – and to defer characterisation.
(d) Ensuring that the treated waste will remain in a stable state during its period of on-site storage – this infers monitoring storage conditions, inspection and possibly tests.

However the constraints of timely decommissioning for ageing facilities may drive towards interim solutions to demonstrate ALARP e.g. further stable interim storage before the final disposable product is produced.

Streamlining the licensing process

The inspectorate, in line with HSE's policy of consistency, has developed its approach to this in the light of our experience in plant construction and the current guidance is:

(a) Decommissioning should be controlled through a series of hold points (licenses) and related safety reports. In decommissioning there is a drive towards timely removal of hazards and the hold point concept is more of drive towards regular review and pushing forward in a considered manner.
(b) Decommissioning safety documentation should broadly follow the same model as that in construction where safety cases are needed for the various stages in decommissioning. These should also drive towards timely decommissioning.
(c) Preliminary safety cases* should classify their implementation on the basis of hazard. In other words, the preliminary case should scope the hazard in enough detail to allow appropriate regulatory oversight to exercised in a proportionate manner.

(d) Decommissioning safety cases should fulfil the same function as operational cases leading to appropriate controls over operations.
(e) Control of decommissioning work should be split down into manageable projects or stages. Their length and rigour will depend on such factors as plant novelty, the hazards being considered and the track record of the duty holder.
(f) There needs to be a balance drawn between engineering quality, timeliness and the extent of the safety case – however, in all cases the balance should be in favour of safety. We also expect such cases to draw relevant experience and practice both national and international. Documents such as those produced by IAEA represent the international consensus.

*Preliminary cases are those which flag up the intent for the forthcoming changes to the plant, lay out the safety criteria, the planned activities and, preferably, the outline forward programme.

The underpinning aim is to ensure that the safety case is at all times fit for purpose, that there is appropriate control of operations stemming from that case and that the case should be valid for a reasonable period into the future. This is the function of any safety case.

The safety case should also justify the order of the decommissioning. For some facilities there will be few options but for large legacy waste stores there will be opportunities to remove the hazardous material in a predetermined order. Our guidance tells us (in brief) to reduce the hazard as soon as possible. However, when commissioning new or reactivated plant the commissioning philosophy we prefer is to present a graded challenge to that plant. Thus, the retrieval order should start with the material with lowest hazard and highest confidence in its composition to ensure that the operations are as intended. Thereafter, depending on that experience, the choice of the following retrieval work will follow. This also means that the downstream treatment plant will also see a graded challenge. Hence, any errors will be made with lower hazard material, enabling and engendering the learning process at minimum risk.

Plainly, the number and significance of each hold point (licence) needs to be judged. However, the aim is to remove unnecessary administration whilst still achieving an appropriate level of safety. The output from such safety cases is not expected to vary from that in "operational" cases, simply that the safety reliances will change with time. Hence, such safety cases will tend to be driven by events and the periodic review required under licence conditions will be carried out as the safety case is consolidated.

Safety case control and consolidation

As decommissioning proceeds, the plant state will change. The safety case must keep pace with these changes and be "live" at all times. What the inspectorate does not expect is the safety case to be rewritten every time there is a change. The model we have is one of an overarching "safety report" supported by a number of "references" some of which will be only partly valid having been modified by other "references". Plainly, this can only go on for so long before the auditable trail become so torturous that it is counter productive.

At that stage, consolidation is needed and, in the interests of economy, the overall case should be reviewed, as long as it is still required.

The real problem is how much complexity can be tolerated. There is no gain for licensees to keep a paper chase going, but adequate safety case needs to represent the plant with reasonable accuracy. This balance can be difficult when the main pressure is to work towards controlling the potential hazard in an inherently safer manner.

DISCUSSION

During these early phases of decommissioning work our experience shows a need for a flexible regulatory approach. The inspectorate recognises this and has adapted concepts used elsewhere in different circumstances to enhance safety improvements in a timely manner. In a critical review of our ways of working we have used our experience from operations and construction we have found ways to improve them in decommissioning. In so doing we have found a number of situations where the normal application of our guidance has been challenged and we are starting to address this in a more structured fashion with the revision to our SAPs. The most significant of these that may also apply in particular circumstances to the non nuclear industries include:

(a) the balance between engineered safety systems permanently installed, safety systems that are not permanently installed and command and control.
(b) the changed emphasis in applying safety case guidance.
(c) the changed emphasis for the regulator as adviser as well as enforcer to enable the safety case regime to engender overall safety.
(d) the use of multi legged safety cases which need particular scrutiny both from our licensees and ourselves.

Overall, the NII position is one of making professional judgments in the light of all the relevant available information. In this the licensee needs to proactively put information to the regulators in order to avoid unnecessary delays and to engender regulatory confidence.

CONCLUSIONS

The regulatory regime in the UK is both flexible enough and rigorous enough to ensure worker and public safety into the future. The NII has attempted to put as much guidance as possible into the public domain to help those with an interest to be aware of its position. This paper has discussed some of these aspects in the hope that they will be useful outside the nuclear field and thereby improve safety in general. All this has been carried out in the light of changing circumstances with the advent of the NDA, progress in decommissioning thinking and the revision to our SAPs (which will have been discussed in open forum with our stakeholders by the time this paper has been published [15]).

ACKNOWLEDGMENT AND DISCLAIMER

Thanks go to many in HSE's Nuclear Installations Inspectorate and BNFL for help and advice in developing this paper. The opinions here are those of the author. No part of this paper should be taken as definitive interpretation of HSE or NII policy, the law, or their application.

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