



## **Radioactive Packaging Spares Management**

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### **ABSTRACT**

Spares used on all radioactive packages for International Nuclear Services Ltd transports must be controlled and managed to ensure the original design basis of the packaging is maintained. They must comply with the original design intent, that is, the package will fundamentally be exactly the same as it was originally, no matter how many components are replaced. This is assured by meeting quality requirements with regard to appearance, dimensions, materials, testing, storage, and fitting. To be assured that these criteria are maintained, INS manages all aspects of spares from procurement and storage through to their issue and use. The procurement process involves purchase via reputable suppliers. This is assured by the use of controlled listings of suppliers who have been evaluated and verified by the Quality Assurance and the Environment, Health and Safety Departments within INS. The evaluation process ensures the supplier is capable of doing the work required by INS, to a suitable standard. This may be by desktop assessment e.g. for small, low value items to regular on-site audits at the supplier e.g. for more complex items. This process includes proprietary 'off the shelf' items and a supplier can not be used unless they have been evaluated. However, this does not prevent competition during the procurement process of new suppliers being added at any time. During the procurement process the spare is graded in accordance with IAEA Safety Guides which will determine the manufacturing process and levels of inspection. For bespoke components the supplier receives detailed specifications and drawings. Depending on the quality grading level required, independent qualification of the manufacture may be required by inspections on behalf of INS both before and during manufacture, as well as prior to delivery. INS also maintain trace-ability of spares, so that should it be found that a spare is faulty for whatever reason it can be determined where the component was manufactured, if there are likely to be any others from that source and whether they may be in-service on other packages. During the lifetime of a package its design may change. Therefore, INS manages the removal of 'out of service' spares and replacement with current specification components.

### **INTRODUCTION**

International Nuclear Services (INS) manages spares for radioactive packages with regard to the requirements as set down in the various regulations, all of which are similar if not word for word. For example ADR 2009 reference 1.7.3 (b) under the heading 'Quality Assurance' states :-

***'All packagings are periodically inspected and, as necessary, repaired and maintained in good condition so that they continue to comply with all relevant requirements and specifications, even after repeated use'***

This same statement is duplicated in IMDG 2008 edition at reference 1.5.3.1.2, in RID 2009 at reference 1.7.3 (b) and again in IAEA Safety Standard No.TS-R-1 2009 edition at reference 306 (b).



In essence what this means is that all packagings used in radioactive movements, must have regular inspections carried out to check that they are still able to function as per the package design intent. The inspections will be such that they can determine if there is any wear or deterioration to the package and its components and or if there is any damage and that items are replaced at the required periodicity. This paper will explain how INS controls spares purchase, issue and usage.

In order for INS to comply with the basic premise as stated in the various regulations mentioned above INS follows the examples as written in Safety Guide TS-G-1.4. “The Management System for the Safe Transport of Radioactive Material” in particular **Section 5** under **PROCESS IMPLEMENTATION** and specifically:-

**5.57 Procurement**

extract “ *Those responsible for procurement should develop appropriate methods to ensure that the requirements for the supplies are clearly defined and communicated and are fully understood by the supplier .....*” &

*“Purchase Documents should contain data clearly describing the product or service ordered.”*

(for quality requirements see below under APPENDIX which is also an extract from TS-G-1.4)

**5.65 Identification, Traceability and Preservation of Materials**

extract “*All materials, including raw materials, components, assemblies, packagings and software, should conform to appropriate specifications and quality requirements before being introduced into production or service.....*”.

**5.80 Inspection, measurement and test control**

extract “*Provision should be made for appropriate testing of the packaging or its constituent parts in all phases of the lifetime of the packaging, in accordance with the applicable specifications, standards and regulatory requirements. ....*”

**Appendix Graded Approach For Management Systems For The Safe Transport Of Radioactive Material**

extract A.1. *The graded approach (also referred to as the graded process) is a process by which the scope, depth and rigour of the management controls to be applied to a specific packaging or transport related component or activity are commensurate with certain aspects, including, but not limited to:*

- The magnitude of any hazard (radiological and non-radiological) involved in the items failure;*
- The impacts of the items failure on safety and security;*
- The impacts of the items failure on the project, facility or business mission;*
- Unique characteristics of the item;*
- The impacts of the items failure on other pertinent factors.*

**Table 2 Examples Of Quality Categories Based On Consequences Based On Failure**

Grade 1	<i>Safety Class – critical to safe operation</i>	<i>Grade 1 items are those directly affecting package leak tightness or shielding, or, for packages of fissile material, those directly affecting geometry and thus criticality control. ....</i>
Grade 2	<i>Safety significant – major impact</i>	<i>Grade 2 items are systems, structures or components whose failure could indirectly affect safety in combination with a secondary event or failure. ....</i>





## **1. Scheduled Maintenance**

All radioactive packages have to be maintained. The form of the maintenance is approved by the Licencing Authority as detailed in the Design Safety Report for the package. For INS, scheduled maintenance also includes what is termed 'turnround' maintenance as well as the usual periodic maintenance some times referred to as 'Annual', 'Basic', 'Major' and 'Periodic'. The term 'turnround' simply refers to all transports of the packages. All components are routinely inspected so any wear and tear is quickly discovered. The 'turnround' maintenance will pick up any deterioration or damage in advance of maintenance regimes based on time.

## **2. New Contracts**

Most stocks of spares will be based around existing contracts, after all why incur additional expenses for packages that have no work. New contracts mean a revision of existing stock is required to ensure there is no interruption of the transports through lack of spares.

## **3. Damage**

Damage is something that despite all efforts to avoid can happen, so for replaceable components it's important to build in a spares contingency.

## **4. Stock levels reaching or approaching minimum requirements.**

Monitoring is an important function and is the cornerstone of Spares Management. At one time spares were automatically procured through the Sellafield Ltd system, since then INS now manages all issues with relation to spares used on packages in INS business, allowing for greater flexibility and control directly by INS.

## **5. Decide On Re-Stocking Quantities**

A balance between immediate need and sensible order quantities need to be determined, as well as new contracts which have to be accounted for. The financial value of the items can also have an impact on the quantity purchased.

## **6. Procurement Process**

In INS the Procurement Process from start to finish starts at item 4 above and completes at item 17 where payment for the spares takes place, and along the way each item can be quite demanding as described below.

## **7. Current Design Drawing**

Radioactive packages have a long life span, otherwise the cost would be prohibitive. Over its lifespan a package can undergo changes that were not in the original design. The responsibility for changes in design rests with the Design Authority for that package. It's the responsibility of the Design Authority to notify users of the package of all changes. For instance:-

- The original package may have been developed pre metric conversion, there are still packages that use Imperial thread fittings, and a typical modification could be a conversion to Metric. It's important that the old fittings are segregated or disposed of, as visually they may well look similar (this is where design changes link to item 21 in the flow chart).



- The design change would be controlled by updating the drawing for these components (and all associated drawings). Specific parts would have a new identification number.
- Material changes due to improvements in technology, or phasing out of older material specifications because the demand is not there. If the original material is no longer available then a replacement must be found that is equal to or better.
  - One example would be imperial dimensions for original materials which are no longer available in that size but come under a metric equivalent.
  - Another could be developments in O seal material to phase out older components due to improvements in characteristics, toxic components being banned, life span both in service or shelf life.
- A package may be used under different circumstances requiring different components due to different times under loaded conditions, higher heat load, different types of radioactivity, new or different transport routes and changes in approval.

All of the above can have a marked impact on packages, and it's important that they are controlled so that inappropriate components do not find their way into the system. INS controls this by keeping most aspects to do with spares in house, design aspects within Engineering & Technical Services, Regulations within Package Approvals, package manufacture and new build spares within Project Services, and ongoing package operation and lifetime spares procurement, issue and disposal within Flask Operations sections. Where the package Design Authority rests outside of INS the above still applies, however control of this is with that Design Authority.

## **8. Current Manufacturing Specification**

The responsibility for the manufacturing specification lies with the Design Authority, however the responsibility for ensuring the correct specification is used during manufacture lies with the demander. In this instance the demander is the person who procures the spares not necessarily the user, however the user must ensure they use the correct spare as detailed in their documentation for changing spares. The 'procurement' demander controls the procurement of spares from processes 7 to 16 while the 'user' demander is controlled via processes 19 to 21.

## **9. Prepare & Distribute Tender Documents**

INS operates procedures for competitive tendering. In this way it demonstrates that it is acquiring 'value for money'. Drawings and specifications mentioned at items 7 & 8 will be part of this document pack. As well as supplying the goods the supplier may also have to carry out other operations that can affect the cost. For instance many items will be subjected to Level 1 inspection. This is where an inspector contracted by INS, independent of the supplier is employed to oversee the manufacture, this often starts before manufacture begins with agreement on the form of manufacture as controlled by Quality Plans. The inspector would be called in to approve various stages of the process prior to allowing the supplier to proceed or may even witness key events. On completion dispatch only takes place once the inspector gives final approval. This way INS is assured that the goods are fit for purpose.

## **10. Tender To Approved Suppliers**

INS operates a system whereby Supplier evaluation and selection of goods or services can only be used when they have gone through an evaluation process. The evaluation procedure looks at



several topics in the areas of Quality Assurance, Health & the Environment and financial security. Any supplier can be considered, but can only be used once they are approved under this evaluation process. There are instances where a single source supplier has to be used, for instance for proprietary goods, where a unique service or goods are only available from one source.

### **11. Exchange Manufacturing Contracts**

All contracts written by INS have terms and conditions attached as specified by our parent company the NDA. Included as part of the contract, will be the drawings and specifications applicable to the goods required.

### **12. Manufacture**

As stated above at item 9 the supplier may have to follow defined Quality Plans to ensure the product meets the requirements of INS.

### **13. Independent Inspection**

Many items used on radioactive packages require some form of inspection independent of the supplier to ensure the goods meet all the requirements. The inspector is there to ensure the correct processes are followed during manufacture, and the supplied goods will comply fully with the drawings and specifications applicable. If during the manufacture there is a problem with a process or component the inspector will also act as a facilitator between INS and the supplier to approve or reject the item, this could be in the form of a Concessionary Application of Production Permit.

### **14. Marking For Trace-Ability**

Trace-ability of spares is important for radioactive packages. This enables you to know where the item came from and that it is the correct component. If a component is found to be faulty, whether to do with the materials, dimensional or appearance it can be checked against the batch in case it is an individual fault or throughout the batch. Marking is part of the manufacturing specification. Where appropriate in the case of O seals, the shelf life should also be included on any labeling. Marking for larger items may be in the form of engraving or hard stamping on the component. For components where this is not possible then stick on labels or marked packaging may need to be used. Segregation of batches needs to be maintained. Where it's impractical to individually identify spares, for instance small nuts and washers then they should be supplied in packets or boxes where the packaging is labeled. However if strict control is required then individual bags may be specified.

### **15. Packaging / Delivery**

At an early stage in the tender process the demander needs to decide how and where the goods are to be delivered in order to facilitate storage and delivery.

### **16. Goods Receipt**

INS carries out Goods Receipts for spares to ensure all that was ordered, is delivered in good condition.



## **17. Arrange Payment**

INS uses SAP (Systems Applications and Products) as its accountancy programme. Where spares are approved by an Independent Inspector the Certificate of Acceptance for the goods also acts as a prompt to pay the supplier. However where goods are supplied as proprietary items not requiring an Inspectors approval, the goods would be delivered to a place specified by the demander. INS would then carry out a goods receipt which would then be entered onto SAP to allow payment.

## **18. Storage (Controlled Access)**

Spares are stored at various locations depending on their usage, wherever possible in locked cupboards. Access to the cupboards is restricted to members of the Flask Operations section of INS only, so that inventory and issue is controlled.

## **19. Controlled Issue**

Withdrawal of spares from stock is carried out by the Flask Operations section of INS. To control their use they are grouped together into individual, lockable spares boxes that are job specific and identified as such. The spares box contains an inventory of its contents and is fitted with a seal and a lock. The spares box is then delivered to the place of work and signed for by a person who then becomes responsible for its contents.

## **20. Control Of Items During Fitting**

The operation of all packages takes place under the control of Quality Plans specific to the task. Where spares are changed routinely the quality plan will prompt the operator and require the recording of the change and details of the replacement. Spares issue will be by the person responsible for the spares box applicable to the job. Cross use of spares from different jobs or tasks is NOT permitted even if the spare is identical, as this could lead to a loss of control and traceability. One example INS were involved in, was when machining of a package lid resulted in a change to the percentage of O seal compression when the lid was re-fitted. To maintain the regulatory compression, the seals were re-designed to bring back the specification for compression. This involved the seal diameter changing meaning existing stocks were no longer usable and were disposed of to prevent them getting back into the spares chain. In addition the seals were given a new component part number and all maintenance quality plans, drawings and specifications changed to reflect this.

## **21. Disposal Of Worn / Damaged / Outdated Items**

The operators are trained not to use spares that are untraceable, maintenance quality plans and instructions are written to reflect this, so any spare that is removed from a package is routinely destroyed, even if it is removed and looks in good order, unless that spare has been removed for some other purpose such as for testing.

## **22. UPDATE RECORDS**

When a spare is removed from the spares box it is recorded on the inventory for that spares box that it was used on a specific package on a particular date. The inventory is returned to INS on job completion and the details recorded for spares usage. In addition the spares fitting is recorded on the Package Spares usage register which is transmitted back to INS along with Certification for job completion, the spares usage for that package is maintained with the package history.



### **23. MONITORING USAGE**

Updating of records is part of monitoring usage which is a general form of stock control. In addition monitoring can take the form of noticing a specific spare or package appears to be getting through spares more frequently than expected, this would prompt an investigation to understand why. This may well point to faulty batches or material, or even fitting wrongly on the part of the operators. INS could then instigate changes to correct the problem.

### **24. FEEDBACK OF USAGE**

If during an inspection something unusual is discovered, the system is designed such that Flask Operations section are notified so it can be investigated.

### **25. Wear**

Wear is a normal consequence of usage, however if it is discovered in advance of what is expected then its application needs to be looked at to find out if the wear is triggered due to some unforeseen occurrence.

### **26. Fit**

Where the fit of a component is suspect, is it a problem with the spare, the package or the operator ?

### **27. Longevity**

Particularly in the case of O Seals, their lifetime performance can be affected by several things: - time under compression, radiation, heat load, contamination by contact with other substances.

### **28. Corrosion / Oxidation**

The discovery of Corrosion / Oxidation usually requires some form of rectification.

## **SUMMARY / CONCLUSION**

The processes discussed in the preceding paragraphs demonstrate how INS implement their obligations to the safe transport and usage of radioactive packages. These processes have been developed to follow the guidelines set out in the various papers as approved by the Regulators.

It is essential in this type of business to develop a spares management system which gives confidence that spares used are fit for purpose, and that only approved spares can be fitted to a package. Failure to do so runs the risk of a catastrophic failure of substandard or defective components, or even the Regulators losing confidence that you are fit to continue doing the work.

## **REFERENCES**

ADR 2009 reference 1.7.3 (b)

IMDG 2008 Edition at reference 1.5.3.1.2

RID 2009 at reference 1.7.3

IAEA Safety Standard No.TS-R-1 2009 Edition at reference 306

IAEA Safety Standard Series TS-G-1.1 (ST-2)

Safety Guide TS-G-1.4. "The Management System For The Safe Transport Of Radioactive Material"