

Delivering Consignment Involving Time Lapse Between Packing and Shipment

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ABSTRACT

Sellafield Limited consigns radioactive material as part of its regular, daily business. Each year over 1,000 RAM packages are consigned from the Sellafield Site and around 10 of these represent significant overseas exports. One of these overseas exports took place in September 2012 when Sellafield Limited loaded and consigned 8 fresh mixed oxide (MOX) fuel assemblies which were safely and compliantly shipped and delivered to a Consignee in mainland Europe. The fuel assemblies had been packed into 2 transport flasks in 2009 and stored in the intervening period. The three year time lapse between packing and shipment brought about many bespoke challenges to the Sellafield Limited consigning team, particularly in respect of payload verification (sensitive to fuel ageing), package maintenance and cessation of plant operations. These challenges were successfully dealt with and the 2 flasks were appropriately consigned and safely delivered to the Consignee in line with all national and international requirements.

This paper describes the preparatory work that was undertaken by Sellafield Limited in anticipation of consignment and how the shipment was safely delivered by working with partners and regulators.

INTRODUCTION

A contract was put in place, in 2008, for a 2009 supply to a mainland Europe utility of 16 mixed oxide (MOX) PWR fuel assemblies. The contract specified that the fuel would be fabricated, packed, loaded and consigned from the UK Sellafield site by Sellafield Limited. The proposed supply configuration was 2 shipments, each of 2 flasks with each flask containing 4 MOX assemblies. The chosen package was the M4/12, a UK designed and manufactured transport flask of which there were only two available to the programme. It was therefore necessary to make 2 shipments with each flask travelling in a dedicated high security vehicle, the two of which would be required to deliver a payload before returning the discharged flasks back to Sellafield such that the 8 remaining fuel assemblies could be destored and the flasks repacked in preparation for the second shipment. Once the second shipment had been consigned the plant was scheduled to be reconfigured to begin a new contract campaign for the supply of MOX assemblies to Japanese utilities.

As the programme progressed through 2008, the logistics of attaining the necessary permissions and aligning the schedules of donor and receiving plants meant that the actual date of consignment was pushed out, eventually being reprogrammed for late

2012. During the intervening period, Japan suffered the tsunami disaster and this delivered a programme impact in so much as the planned Sellafield MOX plant reconfiguration and future schedule delivery was cancelled as Japan was understandably unable to receipt the planned Sellafield MOX deliveries. This had a significant impact on the European deliveries as, in August 2011, NDA instructed Sellafield Limited to put the Sellafield MOX Plant (SMP) into quiescent state and determine the fate of the 600 workers who, until this time, had been employed in MOX fuel fabrication, destorage and preparation for transport to customers.

The European delivery time lapse between 2009 and 2012, with the intervening cessation of MOX operations, brought a number of challenges to Sellafield Limited, some three of which are presented here as an opportunity for wider learning. These are:

- The consequences of the fuel ageing
- The serviceability of the flasks
- The effects of the cessation of MOX operations

Whilst each of these challenges were significant in terms of preserving the safety and compliance of the shipments, the latter is presented in detail as this offered a challenge rarely seen or experienced in recent nuclear transport times.

THE CONSEQUENCES OF FUEL AGEING

In anticipation of a 2009 shipment schedule, radiometric and thermal calculations were undertaken in 2008 to characterise the MOX fuel assemblies in respect of specific activities, total activity and heat load. This data was then fed into the requisite quality and permissioning processes. Upon rescheduling an actual shipment date of late 2012, this data was software recalculated to compensate for the effects of the additional ageing. In simple terms, the decay brought about by the revised shipment arrangements had resulted in an increase in heat load and a decrease in activity. Working in partnership with colleagues from International Nuclear Services, the job of determining which enabling documents were affected by the ageing of the fuel was initiated.

Whilst much of this work proved to be relatively routine there were some bespoke arrangements in place, due to the specific transport route, that would only manifest extremely close to the 2012 shipment date. One such requirement was a country specific license which permissioned the transport of the assemblies within the consignee's country. As this was very much a bespoke requirement, Sellafield Limited and International Nuclear Services were required to resubmit a revised application, with the aged data, only days prior to planned shipment. This was a significant "11th hour" challenge to the Consignor but with the assistance of International Nuclear Services this was successfully attained within 24 hours of application and this dropped the final barrier to enabling a safe and compliant shipment.

Once this final permission was in place, Sellafield Limited carried out extensive validation and verification checks to confirm that all necessary arrangements were robustly in place before the Sellafield Limited Office of the Consigning Authority (a

Senior Management Team with the delegated authority of the Company Executive) met to discuss their confidence in the revised arrangements and provide ultimate sanction for the shipment to commence.

THE SERVICEABILITY OF THE FLASKS

In preparation for a late 2009 shipping date, the two M4/12 packages underwent a turnaround inspection & maintenance immediately prior to the initial 8 MOX fuel assemblies being packed. At this time, the next scheduled basic maintenance on the packages was due in late September 2010, which would have presented no programme challenge had the planned 2009 shipments gone ahead. As the delay in shipment manifest, a Notification of Proposed Alteration (NPA) was submitted to the UK Competent Authority to defer the date for the next scheduled basic maintenance until 2013, thereby allowing for the rescheduled 2012 shipment date. The rationale for the NPA was based on the fact that the packages had not been significantly moved or handled or been exposed to the external environment. This was approved by the UK Competent Authority and validated by their European counterparts. The NPA does state, however, that the flask seals would periodically require replacement to mitigate against the effects of the extended time and elevated temperatures. As the packages were packed in 2009, a seal change quality plan was implemented which was used to successfully enable two seal changes whilst the packages were in a packed, but quiescent, state.

A further serviceability consideration was that there are package handling and lifting tools stored at both Consignor and Consignee plants. The handling tools were stored in an iso-freight container at each respective site and both were subject to periodic visual inspection by the package owner, International Nuclear Services, until final date of shipment in 2012. Similar International Nuclear Services certificated visual inspections were carried out on the transport frames that were used to locate each flask within its respective high security vehicle during transport. All these component inspections were completed successfully and the outcomes were subject to validation and verification by the Sellafield Limited Office of the Consigning Authority prior to sanction of shipment.

Notwithstanding the above, the most significant challenge to the packages' serviceability came about from the need to undertake a scheduled maintenance of the lifting trunnions in mid-2012, prior to the revised shipment date. This maintenance activity would have been undertaken on empty packages at the manufacturer's premises, had the shipment been delivered in 2009 as was previously expected. Given the revised shipment date, there was now a need to undertake the trunnion maintenance at Sellafield whilst the flasks were packed with the first eight fuel assemblies. This "testing whilst packed" was a new concept to both Sellafield Limited and International Nuclear Services, involving changing out the fixing bolts and dye penetration testing of the trunnions, followed by a tensile force load test being applied to the trunnions using a bespoke test rig.

In preparation for the trunnion maintenance & test, a team of Sellafield Limited and International Nuclear Services personnel visited the package manufacturer to be trained on the use of the test rig prior to it being moved to Sellafield for the actual test. Concurrently, a safety case was prepared at Sellafield to govern the delivery of

the maintenance and testing and in mid 2012 operations were carried out overseen by a European safety monitoring agency. Once again the maintenance and testing of a component part of the packages was safely and successfully completed to enable planned shipment dates being met.

CESSATION OF MOX OPERATIONS

In August 2011, the HM Government's Nuclear Decommissioning Authority announced the cessation of MOX Fuel contracts with the Japanese Utilities customers as a direct result of the earlier Fukushima disaster. With a workforce of approximately 600, the Sellafield MOX Plant (SMP) effectively would be moving into a state of clean down, and post operations close out with immediate effect, and maintaining the safety and security of the plant and workforce was of paramount importance. Sellafield Limited consulted closely with the recognised Unions throughout the process to ensure employee communication and engagement remained in place during this unsettling phase. As major stakeholders, the Office for Nuclear Regulation [former Nuclear Installations Inspectorate] were engaged throughout the process in order to ensure that compliance with all Site Licence Conditions could be demonstrated. Sellafield Limited business priorities dictated that there was a requirement to retain Suitably Qualified and Experienced Persons [SQEP] personnel within SMP to carry out the required roles to support final operations, clean down and, ultimately, Post Operations Close Out [POCO] .

Some of the workforce, who would be redeployed into vacancies elsewhere within the organisation, would be required to return to the plant in 2012 to pack the fuel into the M4/12 packages and load these M4/12 packages into high security vehicles for onward transportation into mainland Europe. A Value Stream Analysis was conducted in late August 2011 to determine the numbers and skills of resources required to be retained, and which shift patterns would be appropriate. An exercise was undertaken to identify which of the current MOX employees would be retained to deliver this reduced work scope and which would be considered for redeployment. A mix of criteria was used which included competence, experience, seniority, and voluntary selection. Out of approximately 600 employees, 250 were to initially remain within the Plant leaving 350 workers to be redeployed in a two month period. Of those 350 redeployees, some would need to return to the plant in 2012 and it was vitally important that their SQEP status and familiarity with the plant did not deteriorate during their period of redeployment in other plants.

Working with a resource management community designated as Heads of Profession, the Human Resource function and Directorate Leads worked closely to ensure that the workforce was redeployed into appropriate roles whilst ensuring key individuals committed to their requirement to return to SMP the following year to fulfil their roles as SQEP Packers and Loaders. Refresher training and plant re-familiarisation was undertaken for those individuals who were to return to SMP to support the export, with their 'new' facilities supporting sufficient time away from their new placements to revalidate their SQEPness. Those individuals then returned to their 'new' roles for a short period of time, returning to SMP in the Autumn of 2012 to complete the Packer and Loader activities in support of the 2nd return shipment.

This was an intense and difficult mass-redeployment exercise, which had never been attempted within Sellafield Limited, especially in the tight timeframes for the redeployment. It's success was testament to the employee engagement strategy and full support of the Sellafield Limited Executive which empowered the Heads of Profession and Directorate Leads to retain the necessary skills to support the plant, whilst managing expectations of those initially redeployed who would be returned for two intense, short periods of time brought about by the need to prepare the 16 assemblies for export from Sellafield.

CONCLUSIONS

Despite significant challenges brought about by a three year delay in planned shipment date, Sellafield Limited and International Nuclear Services successfully consigned and transported 16 MOX PWR fuel assemblies to mainland Europe in two consecutive shipments in late 2012. The work to ensure that the issues of fuel ageing, package serviceability and maintaining participant competence were understood and managed was considerable whilst the demands of validating and verifying the revised arrangements also increased substantially. Throughout this, the Sellafield Limited/International Nuclear Services partnership arrangement oversaw the development of a revised preparations plan which was designed to ensure that the safety and compliance of the shipment was preserved throughout and the fuel was delivered in full to the satisfaction of the stakeholders.

ACKNOWLEDGMENTS

The safe and compliant delivery of the shipment described above and the resolution of the challenges therein was made possible by the strong partnering arrangements in place between Sellafield Limited and International Nuclear Services.