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**Survey Requirements of Transport and  
Storage Casks Manufacturing for  
Interim Storage in Switzerland**

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**Abstract**

This paper provides an overview of the survey requirements of the Swiss Federal Nuclear Safety Inspectorate, ENSI, to the manufacturers and associated subcontractors of Transport and Storage Casks for Interim Storage in Switzerland.

In accordance with the Regulatory Guideline for Swiss Nuclear Installations, ref. ENSI-G05, the manufacturing of the Transport and Storage Casks shall be surveyed by a third-party organisation. On behalf of ENSI, the Nuclear Inspectorate of Swiss Association for Technical Inspections (SVTI-N) is in charge of supervising the manufacturing of the Transport and Storage Casks for the Interim Storage in Switzerland.

Besides the supervision of the actual manufacturing process including numerous testing operations and - in case of detected non-conformances or required derogations - the review of deviation treatment forms, SVTI's supervision activities take place at various points before, during and after manufacturing. This includes a review of the documents regarding the production processes and the necessary qualifications as well as the manufacturing. Even after completion of the actual manufacturing process, the check of the QA lifetime records and quality control of the documentation at the subcontractor and manufacturer sites form an important part of the SVTI's work.

Since the cask assembly and the manufacturing of the cask components are done in diverse regions of the world, it is favourable, that the manufacturers and subcontractors are familiar with the survey requirements of the Swiss Authorities. That way, the manufacturers and subcontractors can implement from the beginning on the measures to comply with these requirements. Therefore, the associated financial burden can be considered and also the delays on the delivery of the casks can be avoided.

## Introduction

In accordance with the Regulatory Guides for Swiss Nuclear Installations [1] and [2], the manufacturing of Transport and Storage Casks for interim storage in Switzerland shall be surveyed by a third-party organisation. On behalf of the Swiss authority ENSI, SVTI-N is in charge of supervising the manufacturing of these casks.

By the supervision the following direct safety goals are to be observed:

1. containment of stored materials;
2. radiation protection (shielding control);
3. heat dissipation;
4. prevention of criticality;
5. safe handling;
6. removal capability of stored goods.

The SVTI-N supervision activities consist of

1. prior to starting the manufacturing: review of the applicable documents for the qualifications of production processes and attendance of associated inspections;
2. after successful qualification of production processes and prior to starting the manufacturing: review of the manufacturing documents;
3. during manufacturing: attendance of inspections at manufacturing and testing operations and review of the deviation reports related to detected non-conformances or required modifications as derogations;
4. after manufacturing: check of the QA lifetime records and quality control of the documentation of the subcontractors and manufacturer;
5. at the end of manufacturing: reporting to ENSI about the SVTI-N supervision.

The basis of the supervision activities are the underlying Safety Analysis Reports for the transport and storage configurations, which have been approved by ENSI for each cask type.

A general overview of SVTI-N involvement is given below. However, ENSI can adjust the scope of SVTI-N supervision depending on the review of the Safety Analysis Reports.

### **1. Review of the applicable documents for the qualifications of production processes and of the manufacturing documents**

Prior to starting the manufacturing, the qualifications of production processes can be required by ENSI. The applicable documents for these qualifications are to be submitted to the Swiss authority ENSI for approval, who will decide, which documents shall be submitted to SVTI-N for review. As an example, the documents for the qualification of the applicable Welding Procedure (WPQR) are summarized in chapter 1.1.

After successful qualification of the production processes and prior to starting the fabrication, the manufacturing documents shall be reviewed and accepted by SVTI-N. In the tables 1 to 4 these documents are summarized separated in drawings, specifications, welding book and quality plans. In addition to those, the related lists of components and materials shall also be reviewed and accepted by SVTI-N. Figure 1 shows a page of a quality plan with the main points to be observed according to the Swiss regulatory guide [2].

All accepted documents are marked with the SVTI-N stamp “Requirements fulfilled”, if they are in compliance with the underlying Safety Analysis Reports. Not accepted documents shall be revised considering the SVTI-N comments on the cover letter, in which the results of the review are exposed and precisely justified.

If the underlying Safety Analysis Reports have not been accepted by ENSI, the manufacturing documents can be reviewed and accepted under reserve but only with an official consent of ENSI. Documents accepted under this circumstance will be marked with SVTI-N stamp "Requirements fulfilled" but with the remark “Accepted under reserve of Safety Analysis Reports approval by ENSI“.

Prior to being submitted to SVTI-N for review, all documents shall be reviewed and accepted by the customers. All reviewed and accepted documents marked with the SVTI-N stamp of acceptance shall be included in the QA Lifetime records.

#### 1.1. Documents for the qualification of the applicable Welding Procedure (WPQR)

The welds with containment function shall be qualified under supervision of SVTI-N. For the supervision of this qualification, a quality plan shall be issued and sent to SVTI-N for review. Also, all referred documents in this quality plan, as for example NDE specifications, preliminary WPS, coupons sampling plan, require acceptance by SVTI-N.

After the production of a number of casks, a production test coupon shall be made to confirm the quality of the welding processes used to assure the cask containment.

### **2. Inspections by manufacturing and testing operations**

The SVTI-N inspections are based on a spot-check concept. The mandatory inspections shall be defined in the quality plans with Hold Points (H) and Witness Point (W). In the table 5 the operations to be inspected by SVTI-N are summarized.

### **3. Review of Deviation Treatment Forms**

All deviations shall be recorded in *Deviation Reports* and sent to SVTI-N, who will decide, which of these documents will be subject to SVTI-N for review or if they are considered to be only for information purposes.

Two types of deviation reports shall be distinguished: modification requests and deviation reports [2]:

*Modifications* are required changes from the original design specification defined in the Safety Analysis Reports, approved by ENSI, or from the manufacturing documents, accepted by SVTI-N. Prior to being implemented, the modifications shall be approved by ENSI or accepted by SVTI-N. Modifications can also be requested during a cask series based on the experience gained during manufacturing. A modification can cover more than one cask. Examples for modifications are change of materials, change of weld processes or change of construction details.

*Deviations* are non-conformances to the accepted manufacturing documents, detected during the manufacturing of the casks. Depending on the level of the document hierarchy, the deviations are approved by ENSI or accepted by SVTI-N. According to the evaluation of a dysfunction (delta between as-is and target situation) the following decisions can be taken: scrap, restore to design specification, accepted with supplementary conditions or use as- it is. A deviation shall only cover a singular cask or a singular batch/lot of components, because the repetition of a non-conformance to the design specification shall be avoided through the continuous process of improvement and the analysis of root causes.

Depending on the subject matter of the deviation reports, SVTI-N will review and accept or transfer them to ENSI for appraisal.

The accepted deviation reports will be marked with SVTI-N stamp "Requirements fulfilled". If the Safety Analysis Report has been not accepted by ENSI, the deviation reports can be reviewed and accepted under reserve but only with an official consent of ENSI. Documents accepted under this circumstance will be marked with SVTI-N stamp "Requirements fulfilled" but with the remark "Accepted under reserve of Safety Reports approval by ENSI".

### **4. Check of QA Lifetime Records and Quality Control of Documentation**

After the qualification of production processes, the manufacturing of the components parts and the assembly of the casks, the QA Lifetime Record is reviewed at the manufacturer workshops to check the compliance with the established requirements and the suitability for duplication and microfilming.

### **5. Reporting to ENSI about the Supervision**

After the successful acceptance of the QA Lifetime Records, SVTI-N sends a report to ENSI with the results of the supervision activities. This report is mandatory for the ENSI approval of the interim storage of the cask in Switzerland.

## 6. Conclusions

Since the cask assembly and the manufacturing of the cask components for Switzerland are done in diverse regions of the world, it is favorable, that the manufacturers and subcontractors are familiar with the survey requirements of the Swiss Authorities. That way, the manufacturers and subcontractors can implement from the beginning on the measures to comply with these requirements. Therefore, the associated financial burden can be considered and also delays on the delivery of the casks can be avoided

## 7. Acknowledgments

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## References

- [1] ENSI – Regulatory Guideline for Swiss Nuclear Installations n° ENSI-G05, April 2008: Transport- und Lagerbehälter für die Zwischenlagerung.
- [2] ENSI – Quality Management Guide for the Manufacture and Use of Packaging for the Transport of Radioactive Material, July 2015
- [3] IAEA, Vienna 1996: Safety Series No. 50-C/SG-Q, Quality Assurance for Safety in Nuclear Power Plants and other Nuclear Installations

Manufacturer		Designation of packaging: Serial no.: Component:		Drawing number: Material:		Order number – manufacturer: Order number – customer:		Explanations: M = manufacturer C = customer A = competent authority Entries: H = hold point W = witness point				
Con-secutive no.	Manufacturing or testing step	Applicable documents	Inspection by			Certification as per SN EN 10 204	Written proof required	Confirmations			Comments	Protocol no.
			M	C	A			M	C	A		
Documentation check comments								<b>Production and sequential test and inspection plan (FPP)</b>				
Manufacturer M			Release C			Confirmation A						
Revision	Date	Created	Checked									
Documentation review confirmations								FPP no.:		Page... of ...		
M			C			A						

**Figure 1: Example of a Quality Plan Page [2]**

### 1. Drawings

- for the qualification of production processes
- with transport and storage configuration
- for manufacturing of the parts shell, bottom, primary and secondary lids, and port covers (for transport and storage configuration)
- for manufacturing of the shielding parts
- for manufacturing the parts for the basket as well as for anti-air craft-crash cover
- for the manufacturing of the screws and trunnions
- for welds with containment function on shell, bottom, primary and secondary lid
- for the overlay welding on the sealing areas
- for manufacturing the monitoring system and the metallic seals.

**Table 1: Drawings to be submitted for Review**

2. Specifications for
<ul style="list-style-type: none"> <li>- assembly and testing of the cask during and after manufacturing</li> <li>- the welding with containment function, overlay welding on the sealing areas and of the basket</li> <li>- the manufacturing of shell, bottom, primary and secondary lids, port covers, basket, trunnions, screws and anti-air craft-crash cover</li> <li>- manufacturing of metallic seals</li> <li>- manufacturing and testing of monitoring system</li> <li>- manufacturing of shielding and foreseen neutron absorber materials</li> <li>- repair of the parts with containment function, such as shell, bottom, primary and secondary lids, welds and overlay welding on the sealing areas</li> <li>- heat treatment of shell, bottom, primary and secondary lids, port covers, trunnions, screws and neutron absorber materials</li> <li>- post-weld heat treatment of containment welds and overlays on the sealing areas</li> <li>- NDE examinations (dimensional and visual controls, liquid penetrant, magnetic particle, radiographic, ultrasonic and leak testing)</li> <li>- hydrostatic tests</li> <li>- trunnion loading tests</li> </ul>

**Table 2: Specifications to be submitted for Review**

3. Quality plans for
<ul style="list-style-type: none"> <li>- qualification of production processes</li> <li>- manufacturing of each cask parts</li> <li>- assembly, repairs and testing</li> </ul>

**Table 3: Quality plans to be submitted for Review**

4. Welding Book including Welding Procedure Specifications (WPS) to be applicable on
<ul style="list-style-type: none"> <li>- welding with containment function</li> <li>- overlays, basket, monitoring system</li> <li>- repairs by welding</li> </ul>

**Table 4: Welding Book to be submitted for Review**

<ul style="list-style-type: none"> <li>- Mechanical tests (tensile, hardness, drop weight and impact tests) of following cask parts: shell, bottom, primary and secondary lids incl. their cover plates, screws, basket structural elements, metallic seals</li> <li>- Control of the weld parameter of the welds with containment function</li> <li>- Non-destructive examinations (dimensional and visual controls, liquid penetrant, magnetic particle, radiographic and ultrasonic examinations) of the following parts after the heat treatment or post weld heat treatment: shell, bottom, primary and secondary lids, screws, metallic seals, as well as all welds addressed to containment function and overlays for metallic seals</li> <li>- Dimensional and visual controls of the shielding structure and basket</li> <li>- Fabrication processes of neutron absorber materials</li> <li>- Hydrostatic and trunnions loading tests</li> <li>- Leak tightness tests of metallic seals on primary and secondary lids, and on monitoring system</li> <li>- Control of the chemical composition of the shielding materials homogeneity and isotopes analyse of neutron absorber materials</li> <li>- Review of the quality plans and the lifetime QA records</li> </ul>
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**Table 5: Operations to be Inspected**