OPTIMIZED CONCRETE CONTAINERS FOR WASTE MANAGEMENT

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Abstract

In the last eight years, Siempelkamp verified different types of containers, partly with concrete shielding according to the requirements of German Transportation Regulations as well as to the acceptance criteria for the planned German final storage site, Schacht Konrad. After the process of verifying, more than 1,000 containers of different cubic and cylindrical shape with concrete shielding were produced by Siempelkamp.

In the course of using the containers, certain improvements possibilities became obvious in order to fulfil the handling and transportation requirements. These improvements are based on:

- Protection against improper operational handling on site
- Improvement of surface protection
- Optimization of the lid fixation

Furthermore, Siempelkamp developed a concept to adjust non-qualified containers to achieve the requirements for transportation and storage.

In consideration of a long term interim storage of the containers, improving the containers allows not only a better handling but it also provides an adequate basis for a safe deposition in an interim storage as well as for a later final storage.

I. Introduction

For transportation and storage of low and intermediate level waste, several kinds of different steel and concrete containers are used. The operating requirements for the containers are an easy and safe handling as well as the compliance with the transportation regulations (ADR/RID) and the Konrad final storage acceptance criteria. To ensure the suitability of the containers, several tests and examinations have to be done. The test program consists among others of drop tests (see figure 1), compression tests and of temperature behaviour tests of the containers.

Fig 1: 0.8 m drop test of a concrete container

During daily operation as well as during the qualification tests of the containers some improvement possibilities became obvious. These improvements were implemented during the last years.

Siempelkamp, among other things, operating a container qualifying site and has done the testing for their own produced casks and containers as well as for the containers of the Karlsruhe Research Center. Siempelkamp also supported Karlsruhe Research Center as a contractor in the implementation of the container improvements.

II. Issues for Optimization

Normally, the concrete containers are handled by crane or with a fork lift truck using a spreader. By putting down the concrete containers on a non-planar surface the lower edges may be damaged. The spalling of the concrete is visible in figure 2. To avoid further spallings during the operation process, all new concrete containers are fit additionally with a special protecting edge covering (L-profile) made of steel (see figure 3). This L-profile avoids the damages of the edges and the complicated and cost-intensive repair works.

Fig. 2: Spalling on the lower edges of a concrete container

Fig. 3: Concrete container with edge covering

Another improvement of the concrete containers is the fixation of the container lid. For transportation purposes and interim and final storages the lid of the containers must be connected completely to the container. In case of an accident the container lid must not fall away. The lid of the concrete containers used to be fixed by 6 long metals screws (the metal screws have the form and size like of a walking stick upside down), which are screwed into the inner side of the lid. To complete the fixation, the empty space inside the container is filled up with concrete. The lid with the screws is put down on the container, with the screws going inside the fresh concrete. After the setting of the concrete the fixation of the container lid is completed.

This method of fixating the container lid is quite complicated, since the screws must be placed in between the drums. The handling of the concrete lid is made difficult by the restricted sight, the short time before the setting of the concrete and the dose rate. Therefore, an improvement of the lid fixation is necessary.

Now, the container lid is fixed to the container by 10 screws. The advantage of this construction is that the handling is much easier. Older containers are toughened up by the means of special drilling devices. Ten holes are drilled through the container lid into the container body. After this ten special bolts are stuck into the holes with cement dowels. Screws are inserted into the holes and seized. This method has been accepted by the German Federal Office for Radiation Protection (BfS) and the German Federal Institute for Materials Research and Testing (BAM) and was licensed by the patent office.

Figure 4 shows the drilling devise specially designed by Siempelkamp for toughening the older concrete containers.

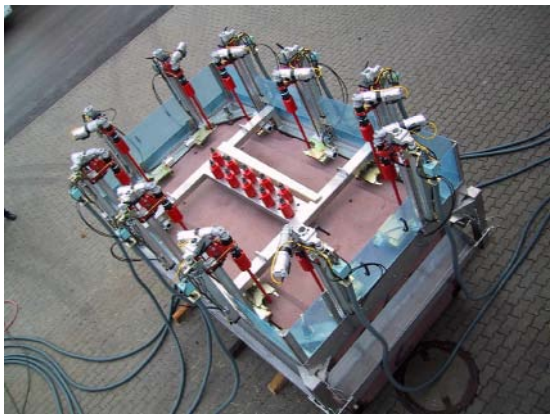

Fig. 4: Siempelkamp machinery for toughening concrete containers

Besides the concrete container, steel containers are also used for transportation and storage purposes. The steel container designed by Karlsruhe Research Center exists in two versions, one made completely out of steel completely (FSC) and one with an additional concrete layer inside the container (PSC). The lid of these containers is fixed by clips and T-headed-screws as shown in figure 5. The disadvantage of this lid lock system is that it cannot be opened or closed remotely driven. The brackets for the clips are also sensitive to corrosion caused by peeled off painting. To improve the lid locking system, the brackets are removed and the screws are seized into the container body (see figure 6). Between the screws there is a welded metal plate for an easy fixing.

Fig. 5: Lid fixing by T-headed-screws

Fig. 6: Improved lid locking system for steel containers

III. Conclusions

The described optimization steps for the concrete containers provide a damage-free long-time handling of the containers. During daily transport of the containers by crane or fork lift truck equipped with spreaders the lower edges of the containers are protected. The added L-profile is an easy but effective method to avoid cost-intensive repair works.

The change of the lid fixation of the concrete containers results in an easy way to close the containers and therefore man dose rates can be reduced as much as possible. Due to the construction of the drilling device at Siempelkamp even older concrete containers can be toughened. Therefore, all concrete containers, independent of their production year, have the same standard of lid fixation.

The improvement of the locking system of the steel containers creates the possibility to close the container remotely driven to reduce the dose rates as well. In this case, the toughening of older containers is not possible. But since these containers fulfil also the requirements of the transportation regulations as well as the Konrad acceptance criteria, a toughening is not necessary.

The improvements provide a safe handling of all containers with a minimum of dose rate and damages in accordance with all regulations.