
Employer: Termoelektrarna Šoštanj d.o.o. Cesta Lole Ribarja 18 3325 Šoštanj				Object: UNIT 4			
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Content

1. GENERAL

EMPLOYER:	**Termoelektrarna Šoštanj d.o.o.** **Cesta Lole Ribarja 18, 3325 Šoštanj**
UNIT:	**Unit (block) 4**
STRUCTURE:	**Cooling tower**
PROJECT NUMBER:	
FOLDER NUMBER:	
PLAN NUMBER:	
DOCUMENTATION TYPE:	**PZI**
DOCUMENATION PURPOSE:	**Removal / Demolition**
DATE:	**Sep 2024 (summary)**

DISCLAIMER:
This document is meant to be a summary technical report in English of the original document. The sole purpose of this document is to give a general information the Unit 4 Cooling Tower removal project. For more detailed information, the original document in Slovene is to be used.

1.1 SUMMARY

This summary outlines the main objectives of the "Removal of Cooling Tower 4, PP Šoštanj" project. The primary goal is the complete and safe demolition of Cooling Tower 4 as part of a broader brownfield redevelopment initiative.

Cooling Tower No. 4 is situated on the northern side of the Šoštanj PP facility (Termoelektrana Šoštanj). Approximately 18 meters from the tower lies regional road No. R2-425/1266. To the south of the cooling tower, about 10 meters away, are the newly constructed Unit 6 buildings. On the east side of the cooling tower, there is a parking lot designated for the workers of PP Šoštanj and the management building.

Figure 1: Areal photo of the area with the Unit 4 Cooling tower

1.2 STRCUTURE DESCRIPTION

1.2.1 COOLING TOWER

The tower was designed by design company IBE and erected in 1973. The tower was designed and build from reinforced concrete. The structural system is a combination of diagonal pillars and horizontal bracing, with the empty space filed by means of thin RC prefabricated shells. The elements were prefabricated, brought on site and then the joints were poured with concrete to form a monolithic joint. As usual for this type of structed the form of a rotational hyperboloid was used. The loading (gravity, wind, etc…) is transferred over the diagonal pillars to the bottom RC foundation ring. The pillars are horizontally braced by a connection ring. The foundation ring is supported by "Franki" piles, also known as Pressure Injected Footings.

The cooling tower is 93m high. The diameter on the bottom is 44.31m, which decreases with height on to 31m at 76m. Then the diameter rises to 31.8m at the top.

Between the levels 0.00 and +15m the tower consists of diagonal columns, arranged in a "X" pattern and without the RF concrete slabs. There are 19 bracing rings, on each ring there are 55 joints, and the number of diagonal columns between two bracing rings is 110.

Most RF elements are made from concrete "MB450", which is like C30/37 according to EN1992-1. The only exception is the ring no 3, which is made from "MB300" (C25/30 as per EN 1992-1). The compression strength was also determined in 2018 by experts.

The reinforcement in the diagonals is "Č.0200" – f_y / f_u = 220/340 MPa.

The joint itself was made by bolting and welding the reinforcement together. And then it was concreted. The amount of reinforcement (number, diameter, arrangement) for the RF elements is known, since old drawings exist.

1.2.2 NOZZLES SUPPORT STRUCTURE

The nozzle support structure consists of a central reinforced concrete (RC) circular shaft. The shaft's walls are 22 cm thick and 17 meters high. Positioned 7.5 meters above the ground is an RC circular water reservoir with a diameter of 18 meters. At this level, there is also a connection between the four main water collection channels and the central RC shaft. Each channel is essentially an inverted "U"-shaped beam with a cross-section of 3.00 by 4.00 meters. The RC structure is supported by rectangular columns measuring 40 by 80 cm. The collection channels were constructed from prefabricated parts and then concreted together.
Further up, there are smaller water collection channels that rest on girders. Like other elements, these collection channels were prefabricated and later cast together to form a monolithic structure.
The entire nozzle support structure is supported by columns of varying sizes (35 by 35 cm, 40 by 40 cm).

1.3 DAMAGES

A team of experts inspected the built-in materials and assessed the structure for any damages. Overall, the outer hull has suffered from the loss of concrete cover, and the reinforcement is corroded. There are cracks in the joints of the rings and diagonals, and the concrete cover is deteriorating.

Cracks were also observed in the RC (reinforced concrete) slabs, and the bolts used during the construction phase have rusted. The RC elements supporting the nozzles are in better condition. However, the concrete has also become carbonated, not only on damaged surfaces but also on undamaged ones. It was noted that the depth of carbonation reaches the reinforcement.

Where the reinforcement is exposed, the bars are corroded, and pitting of the reinforcement is also present.

Figure 2: On diagonal in horizontal elements there are cracks, falling of concrete cover

Figure 3: Damages at joints

Figure 4: Damages on the RC filling slabs together with dirt

Figure 5: Cracks in the RC slab elements

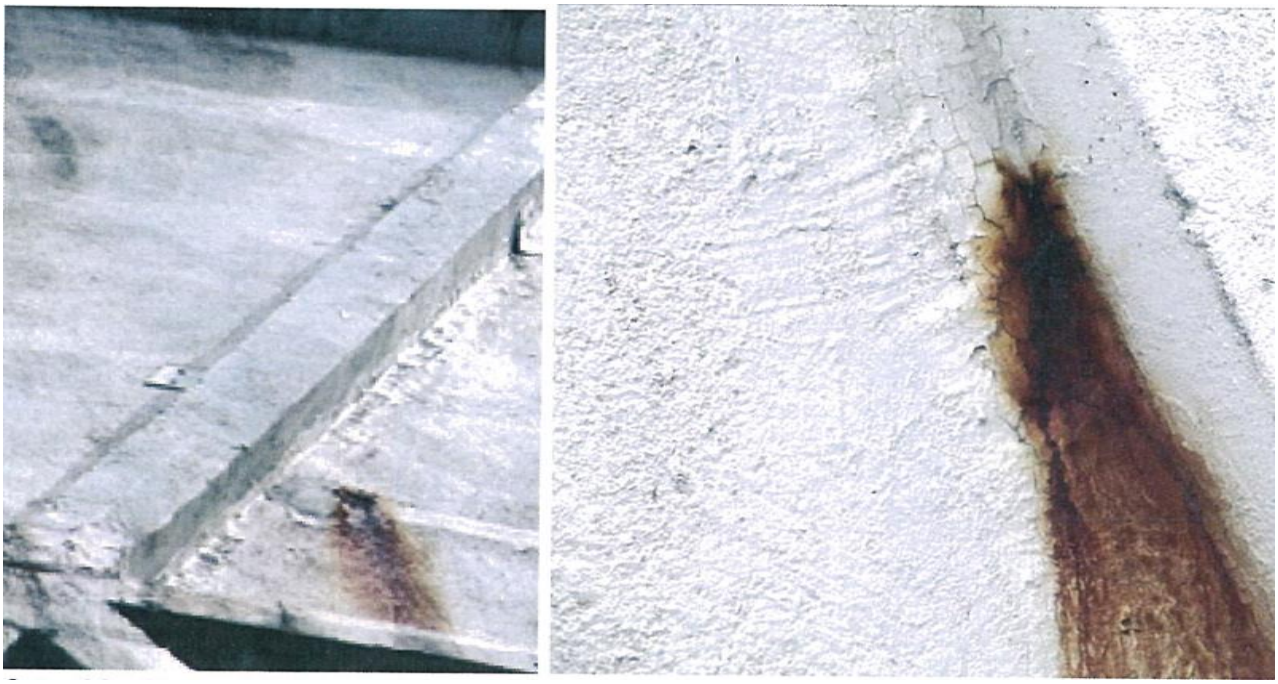

Figure 6: Dagames on construction joints

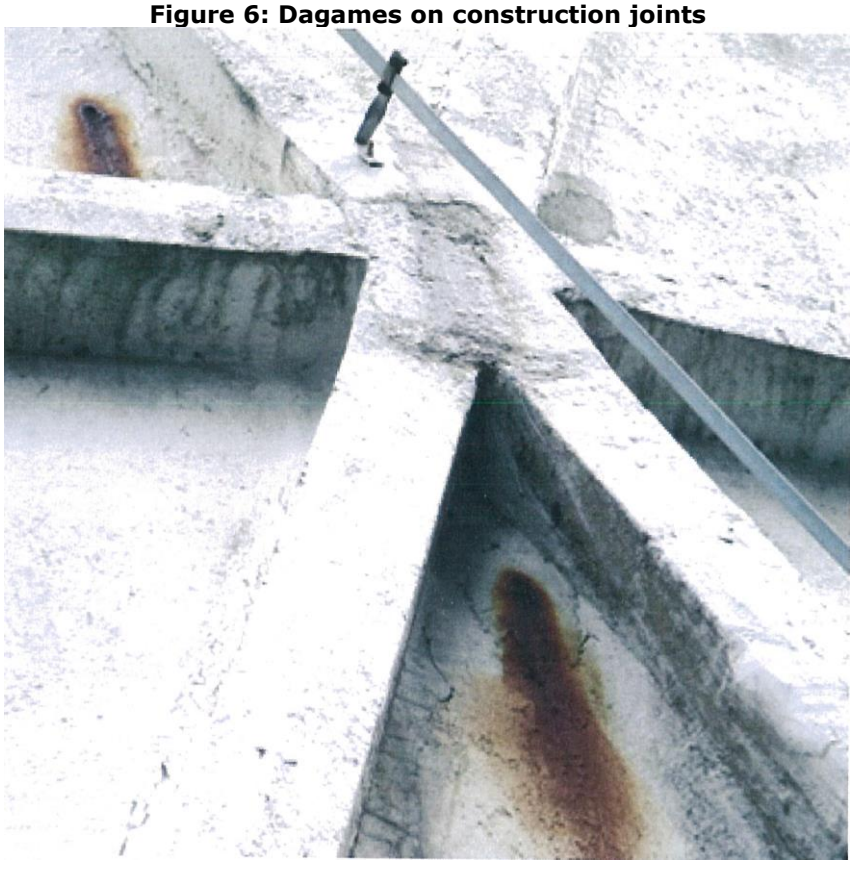

Figure 7: On the RC filling sabs corrosion stains are visible due to highly coorroded reinforcement

Figure 8: Connection bolt's damage

Figure 9: Brace ring damages

2. DEMOLITION

2.1 GENERAL

In this document a summary of a feasible proposal for demolishing of Cooling tower is presented. Nevertheless, the Client can propose a feasible plan of its own, that considers all the restrictions from the Employer and the regulatory authorities. He is also responsible for acquiring all documents, documentation and permissions required by the authorities.

Before the commencement of demolition work, the contractor should thoroughly familiarize themselves with the project documentation, inspect the site, and prepare a demolition technology plan (DTP), which includes at least an execution plan that must be submitted in advance to the Site Authority / Employer, along with a plan for monitoring critical pollution parameters (defined by Employer) and a timetable for the demolition. Based on the demolition technology, the contractor must also develop and present a program of safety measures for work, while the safety plan is prepared by the Employer and handed over to the contractor, who must adhere to it.
In the operation plan, a description of equipment, people, demolition order and the site organisation must be defined. In this phase the Employer must be involved in planning with intention to minimize the work process interruption in the remainder of the facility.

2.2 PREPERATORY WORKS

Before the actual demolition work can begin, the Client must prepare all the documents required by law and the DTP. The highest imperative is the safety of people and property. Therefore, protective measures for the rest of the TEŠ facilities and employees must be prepared (executed, backed by documentation).

Before the demolition itself, a set of preparatory work must be completed, that can be divided into two groups.

1. Works outside the TEŠ Facilities.
   - The nearby roundabout must be temporarily modified (a project already exists) into a normal crossing and at the end it is tuner back into original state. Due to the fact, that the road is a main road without any rerouting possibilities, it is imperative that the road and the roundabout are moved out of the debris impact area as far as possible and protected. The plan for the roundabout exists. The temporary roundabout is to be protected with the concrete barriers (New Jersey type) and steel panels up to 2.5m in height. This kind of protection has the length of 150m. In the road part nearest to the cooling tower a temporary gallery is constructed with a roof.
   - Also some minor modifications of existing infrastructure is foreseen (a shaft modification).
   - Together with the roundabout, a temporary bypass road is to be setup (Lokovica). The road uses the existing minor road, with some modifications and temporary traffic regulation (signs, traffic lights,…).

2. Work on TEŠ premises.
   - Cooling tower's water basin must be emptied, removal of power lines and other equipment at the ground floor.
   - A protective measure for the road and the nearby structures must be placed including the entrance of the parking garage, temporary removal of fences, bicycle shelter, electrical power houses.
   - All the electrical conduits and piping in the vicinity must be de-routed or shielded, this also includes erecting new shafts for the underground piping and conduits.

2.3 COOLING TOWER DEMOLISHION

In this chapter an outline of the demolition procedure based on the mentioned original document is described. A more detailed description can be found in the original document.

Actual demolition:

- Removal of the nozzle's substructure and drift eliminator.
- Steam piping removal from the cooling tower.
- Tower crane erection in the center of the cooling tower.
- Setting up prestressing cables for the temporary strengthening of the structure and prevent unintentional structural collapse.
- Setting up a protective net against debris.
- Careful demolition of upper part of cooling tower with use of tower crane and mechanical pliers.
- Careful demotion of the mantel parts, where small debris pieces are desired to minimize the damage when falling. The mantel is foreseen to be demolished using mechanical crushing pliers while hanging from a tower crane. A whole ribbon must be removed, before moving to a lover level, due to stability concerns. The maximum height of the ribbon it approximately 30 cm.
- The lower part can be demolished using equipment from the ground.

2.4 OTHER REQUIREMENTS

The debris from the demolition must be gathered and dealt in accordance with local laws and regulations. The contractor must provide to the Employer and his Engineering team a detailed plan with descriptions of site organisation, site transportation, safety related issues, protection measures for the surroundings, timetable for the project….

Also, an important issue is the impact of the demolition on the environment. Therefore, measurements of dust, samples from the nearby Paka River and noise must be taken in accordance with the local regulations.

When demolishing the tower, many concrete wastes will be generated. The Client must come up with a way to utilise the surrounding space and set up a procedure to remove the waste efficiently and with accordance with legislation.

3. CONCLUSION

The removal of the Cooling tower Unit 4 is essential project for the Employer. Due to the very limited surrounding space, it is probably unlikely that demolishing by explosion could be used. However, this option is not entirely excluded.
Nevertheless, the presented demolition description is just one of possible ways to demolish the Cooling tower. The Client has the option to follow his plan for demolishing, however, he must obtain all the necessary approvals and permissions from the Authorities for his plan.

Careful preparation is required for this project, especially taking into consideration the nearby main road and the protection of the traffic. Also, the surrounding structures, electrical conduits and piping must be protected to ensure the safe and continuous operation of Unit 6. The debris must be taken care applying local regulations and law, finally, the impact of the demolition itself on the environment must be considered.

4. APENDIX

DRAWINGS:

- Layout
- Cooling tower views