Experience on Primary System Decommissioning in José Cabrera NPP

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1. Introduction

After 38 years of energetic production, the first Spanish Nuclear Power Plant in operation, José Cabrera, a 150 megawatt pressurized water reactor (PWR), shuts down in 2006. During the next 4 years, conditioning works are carried out and finally, in 2010, the National Waste Company (ENRESA) assumes the installation ownership in order to perform José Cabrera NPP Decommissioning and Closure Plan (DCP).

Primary System Decommissioning belongs to DCP works and its scope includes: Steam Generator, Pressurizer, Refrigerant Circuit Pump and Primary Circuit Piping. All these dismantling activities were carried out on site, including preliminary steps before their removal (SAS installations, pre decontaminations, cutting and segmentations, segregations, etc.) and delivery to media/low activity nuclear waste disposal site.

2. Methodology Selection

There are many variables to analyze and take into account before designing a big component decommissioning strategy (always according to ALARA philosophy). Most important are:

Preliminary radiological data study: it determines hot points removal, shielding needs and/or previous decontamination viability.

Cutting methodology study: it depends on the material nature, contamination, thickness, part geometry, ventilation conditions, etc.

Container definition (type and quantity) to final delivery and removal operations.

Confinement study and ventilation needs.

As a result of all these studies per component, and due to the additional difficulty regarded to cut on site, our experience have proved that using diamond saw as the main cutting methodology to Primary System decommissioning has been successful in a huge range of terms (versatility, timing, cost, low contamination dispersion, less radiation exposure, etc.).

Mechanical and thermal cutting methods were also used in other components segmentation, mainly from secondary system (such as piping, tanks, heat exchangers, etc.) since they were classified as very low activity wastes.

3. Diamond Cutting Saw

One of the most important advantages of cutting with diamond saw is its versatility. It works on carbon and stainless steel, allows vertical and horizontal cuts (quite useful in limited space areas), hardly disperses contamination (cold technique) and has remote control, which is essential to avoid long permanence in high dose rate areas.

Below there are illustrated two cutting examples of this versatility mentioned before.

Fig.1. Refrigerant circuit pump cutting

Fig.1. shows two vertical cuts performed on stainless steel (316 STT). The maximum thickness of the pump wall is 390 mm.

Fig.2. Pressurizer cutting

Fig.2. shows one horizontal cut carried out on carbon steel wall (80 mm thickness).

4. Steam Generator cutting with diamond saw

After being dismantled all the Steam Generator secondary system with thermic cutting (humidity separator, cyclones and barrel until the truncated zone) started primary and secondary systems decommissioning together on site, using in many phases diamond saws.

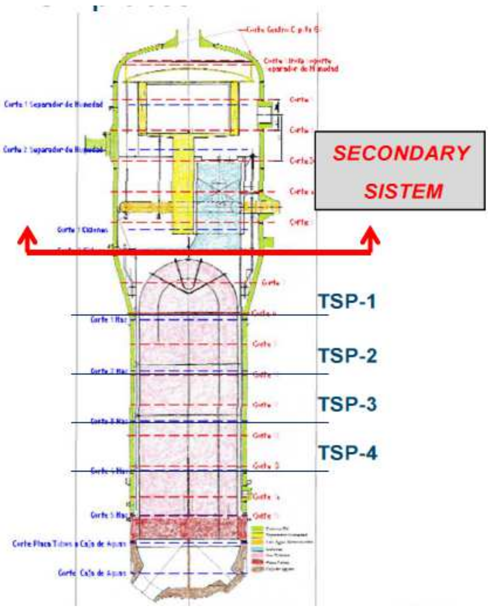

Fig.3. Steam Generator sketch

The remarkable difference with regards to the examples shown in the previous point is the mix materials. In both cases the material to be cut was the same (only steel) and, moreover, all the surface of the material was continuous.

For the Steam Generator decommissioning strategy (primary system) different scenes of mix material cutting were performed.

4.1. Mix material cutting: carbon and stainless steel

According to the strategy for the Steam Generator decommissioning, the first cut with diamond saw was designed to be carried out under the top TSP plate (TSP-1, see Fig.3.). In this activity was included the wrapper (carbon steel) and the primary tubes (stainless steel), as it is shown in Fig.4.

Fig.4. Steam Generator cutting under TSP-1

An additional difficulty found was the material discontinuity, due to the space between wrapper and tubes, tubes vs. tubes and the empty of the tubes themselves. This lack of material can produce diamond wire disarranges and, in the worst case, the diamond pearls can be hooked and/or break the wire.

After having tested in mock up simulations in our factory, several improves were developed and added to the cut process with success. This type of cut was repeated all over the Steam Generator till the primary chamber (concretely six times, twice per TSP plate, cutting above and below it) having reached great efficient results in terms of cutting speed, diamond wire durability, etc.

4.2. Mix material cutting: stainless steel and concrete

Once the top part of the tube bundle was cut (including below TSP-1 and the barrel upper part), the total set was moved into a SAS to be concreted. After that, two diametric and vertical cuts were performed with diamond saw (as it is illustrated in Fig.5.) and the four resulting parts were removed into containers to delivery to media/low activity nuclear waste disposal site.

Fig.5. Steam Generator top set after concrete, cut and first part removal

5. Conclusions

There are many cutting techniques available in market (most of them proved with positive results) as well as there are many different approaches about how to manage radioactive wastes in decommissioning projects (containers or great components disposal, containers burial, re fusion, etc.). Both issues are linked and, before starting a new project, it might be positive and quite useful to compare and study previous dismantling experiences, especially the lesson learned chapter.

Primary System cut with diamond saw has been a challenge target, not only due to the methodology innovation (since until nowadays, the common use of this technology was performed in cutting concrete walls) because it has a huge range of positive aspects that, in our opinion, are attractive (apart from its mentioned versatility, in terms of cutting on site and every type of material). Outstands its cold cutting nature, very appropriate to cut contaminate components, since its contamination dispersion is minimum.

REFERENCES

[1] ENRESA, Plan de Desmantelamiento y Clausura de la C.N. José Cabrera. Especificación técnica para los trabajos de desmontajes radiológicos, Jun., 2010.