

## CEMENTATION PLANT FOR RADIOACTIVE WASTE

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### ABSTRACT

The cement vermiculite solidification agent is no longer accepted by the Spanish authority. A new cementation plant has been designed for José Cabrera Power (PWR 150 MWe) which is going to substitute the old cement vermiculite system by a new cementation plant for the solidification of the liquid radioactive waste generated in the power plant.

### INTRODUCTION

The new system has to solidify in a cement matrix up to 45.000 p.p.m. of boron from evaporator concentrates and spent ion exchange resins (Amberlite IRN 150 and Amberlite ARC 9351).

It has been selected an in drum mixing technique due to a rather small volume of waste generated per year (15 m<sup>3</sup> evaporator concentrates and 0.5 m<sup>3</sup> resins).

The dosing of each component is done by weight including the amount of resins and water required for the solidification.

The solidified product fulfil the requirements demanded by the authorities for final storage.

### DOSING OF CEMENT AND ADDITIVES

The cement and additives required for liquid waste immobilization are dosed outside the controlled area according to a previous recipe calculated during the specimen verification. The dosing of the necessary weight of dry product (cement + additives) is done semiautomatically, once the operator has set in the local control board the amount of dry product required. The drum with its dry content inside is transported to the controlled area for the dosing of concentrates or resins.

### DOSING OF CONCENTRATES AND RESINS (Fig. 1)

This section is located in the controlled area.

Concentrates reach 28.5% boric acid (in the form of borates). The boric acid neutralized to a pH between 6.5 and 7.5 can be stored without risk of crystallization at 40°C.

The dosing of concentrates is performed through a small tank B003 of 200 l. The amount of concentrates discharged to the drum is measured by weight. The discharge of concentrates (between 114 to 125 Kg) is done in at least two batches. This features allow a better homogenization of the product and avoid a complete discharge of the dosing tank.

The spent resins are sent by flushing with water from the mixed bed filters to the resin tank B001. In this tank the resins are dewatered against a screen filter F001 by means of a membrane pump P002.

The water is sent to the B002 tank. When a high level is reached in B002, the water is sent back to the waste tanks of the plant.

The weight of dewatered resins is known continuously. Later and according to the master ratio cement and resins is added the necessary water for the cement hydration. The homogenization of the resins is performed by recirculation through P001 pump. After several minutes, the mixture water + resins are sent by P001 to the dosing tank B003.

### MIXING EQUIPMENT (CEMENTATION CELL) Fig. 2

The mixing process is an in drum mixing. (KfK license). The mixing of the waste with the cement and additives (previously dosified) are performed with a planetary mixer. The mixer is inside a hot cell provided with a shielding window for observation of the process. Also the cell has a sluice for active sampling, compressed air, demineralized water, etc. A master-sleeve manipulator allows the operator to work inside the cell. The cell is maintained under pressure and the air goes through a prefilter and a HEPA filter, and later the air is discharged to the general HVAC system.

The mixer is composed of two stainless steel screws which rotate in contrary directions, this effect and a planetary movement gives a very effective mixing performance. The estimated time of mixing-discharge-mixing is about 15 minutes.

### CAPPING STATION

The capping of the filled drums is performed in a semi-automatic way. The lid and the ring are prepared by the operator in a radiation protected area. The lid and the ring are transferred to the capping point where the drum is waiting. The subsequent operation are done automatically.

### SETTING AREA AND TEMPORARY STORAGE

Once the drum is capped, it is transported to a setting area where the drum remains at least 24 h (setting time).

This area allows also a temporary storage previous to the transport to the on site storage.

### CONCLUSIONS

This solidification system is going to be erected during March 1.992. This plant is going to replace an old cement vermiculite immobilization process. The requirements asked for regulatory authorities to the final product has been completely fulfilled.

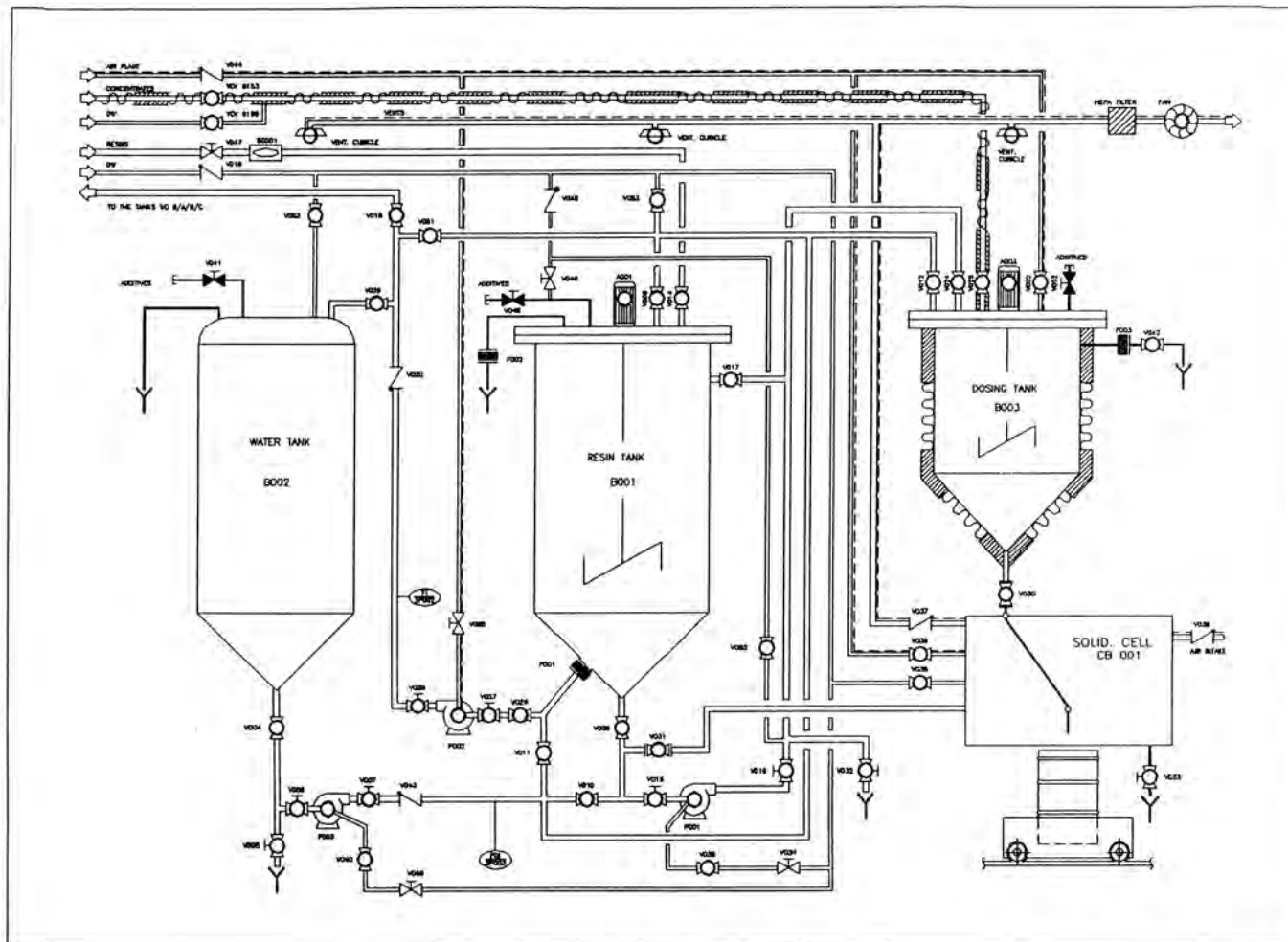


Fig. 1.

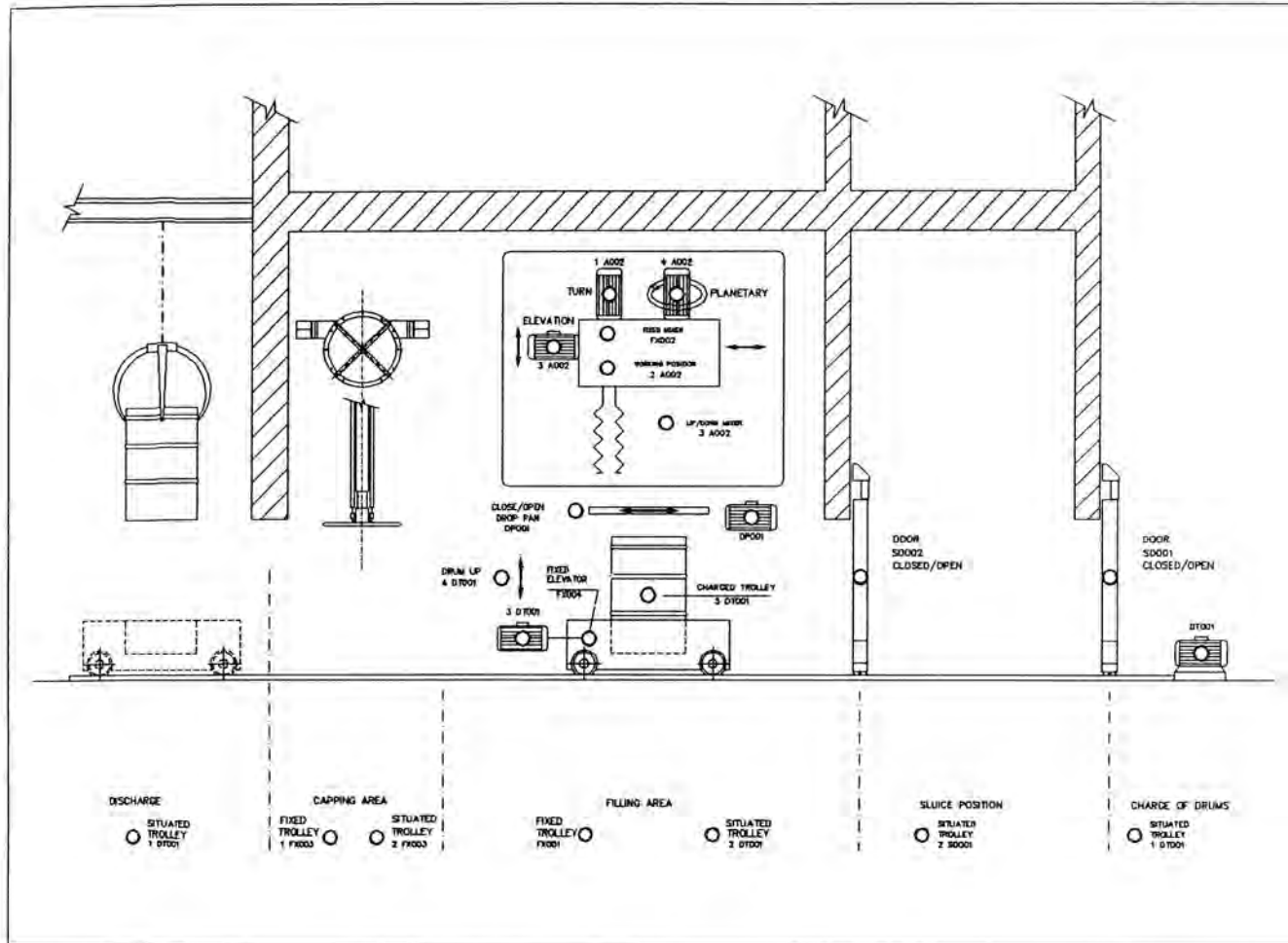


Fig. 2.