

A New Drying Facility for LL and IL Waste in a Special Designed Building

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1 Introduction

During the operation and shut down phase of Nuclear Power Plants different kinds of radioactive liquid waste is produced. In Nuclear Power Plants (NPP) with the available water treatment (evaporation facility) the liquid waste can be treated in the first process steps (mostly concentrated in evaporators). The waste is conditioned for final storage in on site drying facilities or via mobile drying facilities brought to NPP's. The GNS company is successfully operating the mobile drying facility called FAVORIT for many years.. The drying facility "FAVORIT" has a valid handling authorisation throughout the federal republic of Germany according to paragraph § 7 of the governing radiation protection ordinance (StrlSchV).

During a period , when a NPP is shut down and the on site facilities for the liquid waste treatment have been taken out of operation, the conditioning of this waste stream has to be performed at external location.

2 New Plant

2.1 GNS – Conditioning building

At a further step of decommissioning, the infrastructure for a mobile conditioning facility may no longer be available. For this and other reasons, it may be necessary to build a dedicated external installation for the treatment of any kind of liquid waste.

To guarantee the treatment of these waste streams at present and in the future, GNS started to build a new dedicated treatment building for final conditioning that includes buffer storage of 30m³. The construction of a new conditioning building near the Research Centre Jülich is currently being pursued by GNS

With this new conditioning facility it will be possible to increase the decommissioning of nuclear plants.

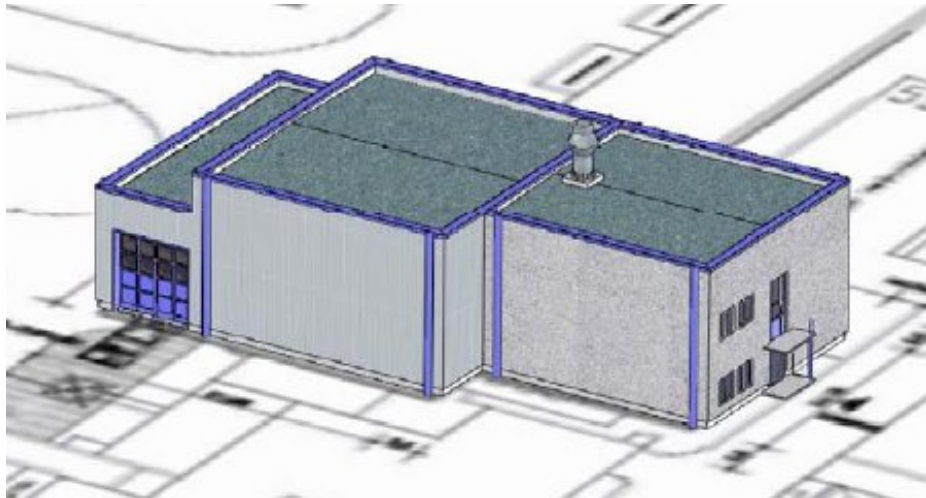
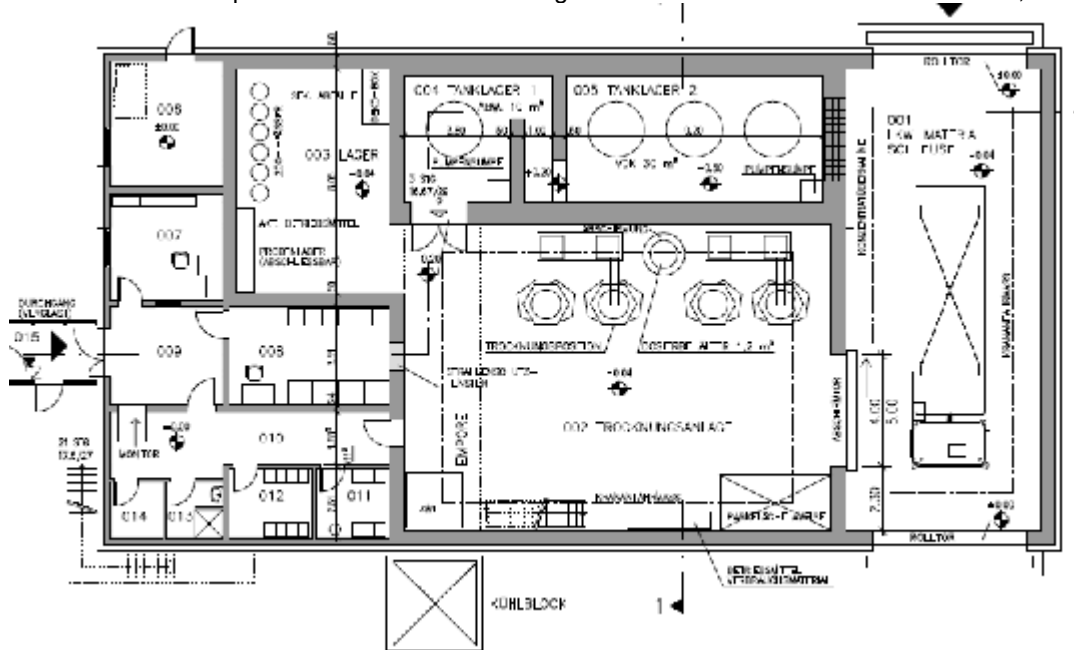


Fig. 1: the new GNS treatment building

For the required plant equipment to treat the liquid waste, parts of the conditioning building have to be dedicated as control and surveillance areas according to paragraph §36 of the governing radiation protection ordinance (StrlSchV).

To accommodate these components the treatment building dimensions will be about 20m x 30m x 9,5 m (LxWxH).



The access for the employees is at the main entrance of the building (not shown in Fig. 2). The access for material and Trucks is at the Truckbay via appropriate rollup doors.

- Shielded cover and walls in the area of the in drum drying area and the Truckbay (about 50 cm).
- Shielded cover and –walls in storage tank area
- Classification of the building in control- and surveillance area and personnel contamination monitors for whole body monitoring at the crossing points
- Exhaust air from the control area is filtered several times and then return back to the environment
- Operating the plant technique outside the control area
- Storage area and locks are preformed with ground receptacles

The aim of GNS is for the construction of the drying building to be built quickly so that the drying of the liquid waste can begin soon. Planning work has begun and equipment has already been manufactured.

2.2 Plant Equipment

The drum drying facility is designed to evaporate the concentrate in 400 l drums or in MOSAIK[®] shielded iron casks in four parallel operating drying units (working independently).

The liquids are delivered in a tank container via Truck through the Truckbay. Hermetical hose connections are provided to transfer liquid waste to the storage tanks.

A vacuum drying process is used for drum drying. The drum / cask are enclosed in a heating system. The condensation system is evacuated to 2 to 5 kPa (absolute pressure). The produced vapour from free and bonded liquid, caused by the drying process from the waste product, is condensed in the condenser guided via the particle-filter.

The advantage of vacuum drying is 1) a suitable waste form for final storage is produced and 2) the huge reduction of radioactive liquid waste volume (about factor 6). The approximately drying capacity of the four line in drum drying facility is about 480 litres per day.

The prevailing vacuum during the drying process makes an exterior leakage almost impossible.

The concentrate storage consists of 3 tanks (10 m³ each) and one tank for storage the condensate (about 10 m³) which accrues during the drying process. A dosing tank with a volume of appr. 1.2 m³ is located next to the four drum drying units. Liquid waste from the dosing tank will fill the drum/cask. Each of the four drying stations is connected to a separate vacuum unit equipped with a liquid collecting tank to take over the condensate and the exhaust air from the drying process. The condensate is transferred out of the drying facility via cyclic progression to the condensate buffer tank of the conditioning building.

An air cooled cooling unit will be used to provide the condenser with the necessary cold water flow. To prevent extra heat generation in the building, it will be installed outside.

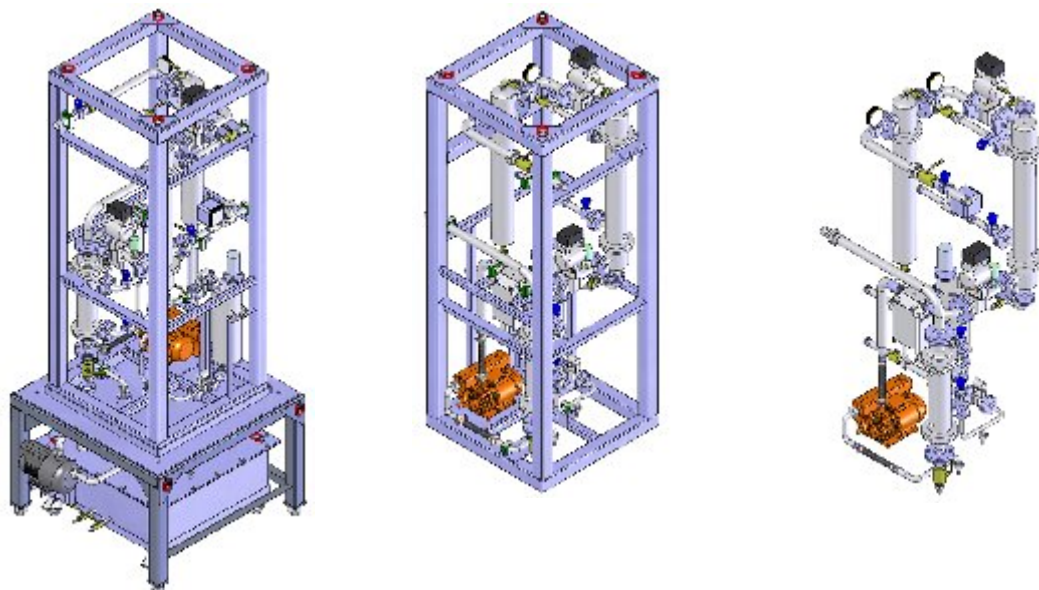


Fig. 3: Vacuum unit with a new designed exhaust air condenser and liquid collecting tank

Drum drying units with proven GNS design have been in service for many years. Some parts were re – designed for this new building. There is an extra vacuum unit with a vacuum pump, a particle-filter and condenser for each drying unit, to optimize the plant availability. The vacuum units are identical and can be replaced mutually (modular design). One of the vacuum units has an extra second condenser to dry the exhaust air from the liquid collecting tank.

Every vacuum unit is designed and manufactured with a square bar frame made out of high-grade steel. The essential components like the particle filter, the condenser and the vacuum pump are fixed within the vacuum unit. The advantage of this improved construction is a compact design where all important components are in one unit. Every drying line therefore has all the necessary filtering and condensation components. All parts which contact fluid are made out of high-grade steel (for example condenser, particle-filter housing, piping and instruments).

The condenser is specially designed for the vapour capacity of the heat elements, to optimize concentrate drying. Through close cooperation between GNS and the supplier of the heat elements, a further improvement for the segmental heat elements to nearly eliminate the air gap with the drum / cask .

An overhead crane with a load of capacity of 12.5 Mg will be provided to handle drums and casks.

3. Plant automation

The operation of the in drum drying facility is full automatic. In the program the tank is chosen by the operation personal. After that the dose tank is going to be filled up and then the vacuum transfer runs in the chosen drying line. The operating personals are put in for regular patrol and for loading and unloading the tank station. This is made possible because the appropriate control system takes over the work for the right measuring concentrate, accruing condensate and the right filling level in the drum / cask.

Different as the previous mobile FAVORIT-facility, is the extra dosage of the concentrate done full automatic in the drying line. The full automatic controls of all important ball valves are driven via double acted pneumatic drivers. All important process parameter separately catches and handled by the automatic control system per each drying line.

The in drum drying facility can be directly operated via Touch-Panel at the control cabinet, in the control room, which is out side the radiological controlled area. In the control room there is an appropriate PC-workplace where the entire facility can be operated. The digital recordings from all important process parameters (like the amount of concentrate and the amount of the condensate over a period of time)can be monitored . Because all the process parameter can be directly located to each drying line, it is possible that all documents can be shown at the PC-workplaces.

The following operation can also be conducted automatically:

1. The transfer of concentrate from the delivering tank-trucks to storage tanks
2. Heated concentrate storage tanks, depends of medium
3. Mixing program, to avoid the settling of solid material in the concentrate
4. Washing program for storage tanks and piping systems

The cyclic drain of liquid from the condense storage tank is fully automatic. . Additional to the full automatic operation of the facility, it is provided with a manual mode. The manual mode can only be operated in the installation space. It is used for trouble shooting or maintenance.

4. Summary

To guarantee the treatment of radioactive waste liquid from nuclear plants at present and in the future, GNS plans to construct a conditioning building with liquid buffer storage near the research centre in Juelich. In this conditioning building GNS will put in a four line in drum drying facility and storage tanks for the evaporator concentrate. The planning work has already started. The necessary process equipment has already been manufactured. The aim of GNS is to build the drying building rapidly, so the drying process of waste liquid can begin soon.

Because of the new construction of the conditioning building, GNS had done some further development for there mobile drying facility FAVORIT, which has been used very successfully for many years. For this new construction the components of the vacuum unit were redesigned and optimized. The main advantage of this new design is that the structure is much more compact with all the important components contained in each vacuum unit. Every drying line has all the available components, for the filtering and condensing process. The control of the drying facility is performed automatically, so that the operating personal are just only required to patrol and to load and unload the drying stations.