DECONTAMINATION OF TN 17/2 FUEL TRANSPORT PACKAGING MATERIAL

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Abstract

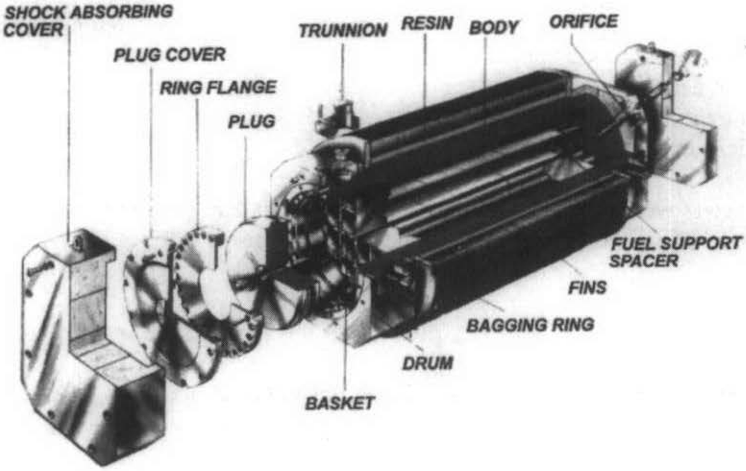
SUMMARY

TN 17/2 transport packaging units that have been used for the transportation of irradiated fuel are contaminated internally. They have to undergo a special operation to be used for in a new configuration.

In order to be reused for the transportation of fresh fuel, these packaging units need to be decontaminated.

Complete decontamination requires solving the following problems:

- selecting the decontamination processes
- non-destructiveness
- implementing the process on TN 17/2 packaging units.



Overall view of packaging

DECONTAMINATION PROCESSES

The packaging units can be contaminated by labile and fixed contamination. Therefore, decontamination processes, specific to each case, must be used.

Labile Contamination

Labile contamination can be removed by non aggressive conventional processes, such as high pressure water, soapy water, trichlorethane 111 (or a substitute). These 3 processes have been used successively.

Fixed Contamination

In the case of fixed contamination, it is necessary to remove the superficial oxide layer covering the base metal, where the contamination is fixed. Aggressive processes are required. We used two different processes:

- electrochemical decontamination
- special decontaminating gels, called "Glygel".

Electrochemical Decontamination

The process consists of running a direct current between the surface to be treated (anode) and a counter-electrode (cathode), through an electrolyte.

The surface is decontaminated simultaneously by oxide disintegration and by anodic dissolution on the subjacent base metal.

The process is controlled by the following parameters:

- electrolyte composition and temperature
- anode current density
- duration of treatment
- rinsing efficiency.

These parameters were selected according to the materials that compose the packaging unit, and the type of contamination fixation for the following steel grades: A316, A316L, A304L, A308L.

Glygel

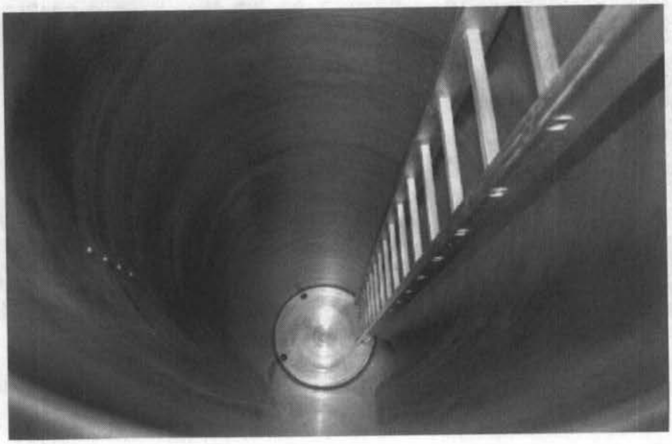
Glygel contains a decontaminating agent. The decontaminating agent for packaging units is a Cerium IV- based oxidant.

Glygel also contains a viscosity agent, providing particular rheological properties. Its pasty consistency allows it to stick to the surfaces being treated, while the decontaminating agent is active. This is to particularly suited to decontaminate small diameter orifices with a complex geometry.

NON-DESTRUCTIVENESS

For decontamination using aggressive chemical and electrochemical processes, it is important to test the effects these may have on the materials treated in order to avoid any premature loss of their mechanical and physical properties.

IMPLEMENTATION OF THE DECONTAMINATION PROCESSES



Overall view of packaging cavity

Electrochemical Decontamination

The electrochemical decontamination has been implemented in two different ways, according to the geometry and accessibility of the surfaces to be treated.

Electrolyte Buffer Treatment

All large surfaces, such as the packaging cavity wall, are treated by area with a surface equivalent to that of the counter-electrode, also called "buffer". The buffer is covered with a fabric called "bonnette" or hood, saturated with electrolyte. The electrolyte which is expended when used is collected in the lower section.

As the anode current is running through, the buffer is moved manually until the whole surface to be decontaminated is covered.

A buffer is designed and fabricated for each particular geometry, such as collars, the cavity, or the packaging bottom end.

The buffer is also used for internal threads in the packaging upper section. In such a case, the buffer is cylindrical.

Treatment of plug flat walls using a mobile buffer

Buffer treatment of an internal thread on the packaging upper section

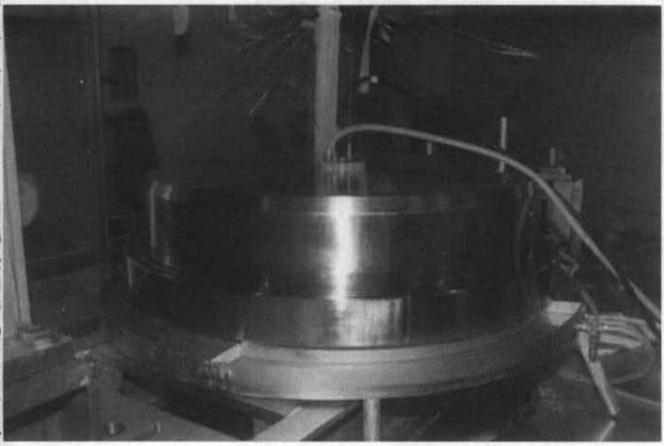
Treatment of cavity interior using a mobile buffer

Bath Treatment

The 3 orifices in the cavity and the plug orifice have complex shapes, including internal threads, collars, machining, etc. The surface treatment requires a precise command of the treatment parameters.

In this case, we use a fixed counter-electrode. It is positioned in the orifice and takes the shape of the orifice with a precise inter-electrode gap. There is no "bonnette" between the counter-electrode and the surface treated. The electrolyte flows in closed circuit. Decontamination is performed by acting on the current quantity being generated.

Insertion of a counter-electrode into one of the lower orifices



Electrochemical decontamination using a special electrode for the plug central orifice

Glygel

Decontaminating gels are used for the treatment of "inter-joint test pipes". These pipes, no bigger than a few millimeters in diameter, are elbowed and sometimes have vertical dead zones.

The gels are injected in these orifices. They are pasty enough to remain on all surfaces during the entire time that the chemical agent is active.

After rinsing, an endoscope check is carried out to guarantee the absence of solid residue.

Rinsing

Following the implementation of each process, a careful rinsing is carried out using demineralized water. Strict continuous measure checks of the rinsing water conductivity, which cannot exceed 15 µS/cm, guarantee the absence of chemical pollutants.

Manual cavity finishing

RESULTS OBTAINED

Four packaging units have been treated in 1997.

This chapter provides an overview of the average results obtained.

Labile Contamination

This contamination is translated by measuring the activity removed from the surface using smears on a 300 cm^2 area.

Before decontamination:	contamination by α and β emitters	> 100 Bq/cm^2
After decontamination:	contamination by α emitters	< 0.04 Bq/cm^2
	contamination by β emitters	< 0.4 Bq/cm^2

Fixed Contamination

Measuring the dose rate 50 mm from the packaging cavity wall.

Before decontamination:	approx. 0.2 mGy/h
After decontamination:	< 0.01 mGy/h (device detection threshold)

CONCLUSION

The results obtained show that it is technically possible to decontaminate transport packaging.

Such a decontamination can be justified economically in various cases:

* for reusing packaging units: it is then an advantageous alternative to the fabrication of a new packaging;
* for the downgrading of an end-of-life packaging: waste processing can be simplified.

There is a range of processes which, used judiciously, allow to treat all surfaces of a packaging.