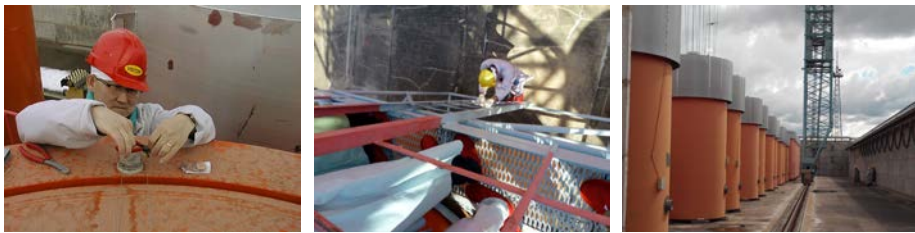


Ultrasonic Optical Sealing Bolt (UOSB)

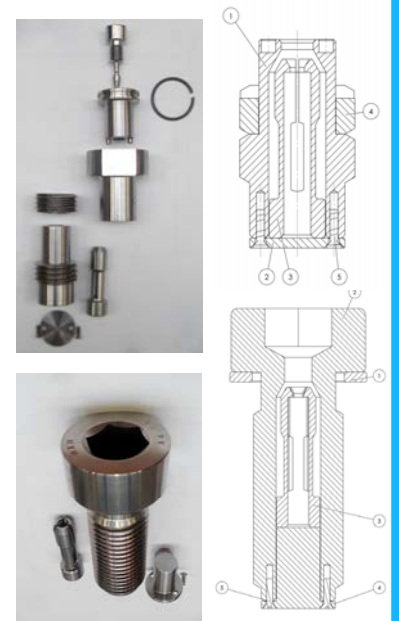
The need:

- ▶ Enable easier and safer sealing verification of the dry storage casks, first application on Castor and Constor casks in Ignalina (Lithuania) requested by IAEA and Euratom Safeguards
- ▶ Replace the standard drilled bolt in use with an anti tampering bolt
- ▶ Avoid unnecessary climbing on the top of the cask with the vertical ladder
- ▶ Unattended monitoring from headquarters



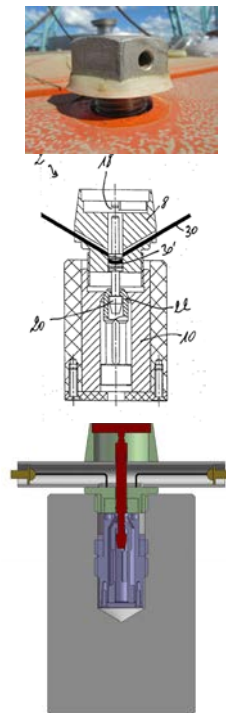
The casks:

- ▶ In Ignalina two types of casks are used, the Castor and the Constor casks
- ▶ The Castor has a lid closed by Allen M36 bolts, an UOSB is put instead of an Allen bolt and must have the same mechanical strength
- ▶ The Constor has a welded lid, an UOSB is put into a blind threaded M36 hole, and has no particular mechanical strength
- ▶ Inserts with collets are put inside both threaded holes



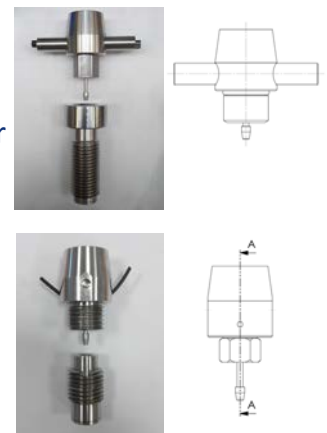
The concept

- ▶ Based on the replacement of the standard bolt with an ultrasonic bolt seal
- ▶ An optical fiber passing through the seal is connected to an electronic seal
- ▶ An insert with a collet is tighten into threaded holes
- ▶ When the seal is installed, the seal's integrity is trapped into the collet
- ▶ When the bolt seal is removed, the integrity is broken and the fiber is cut
- ▶ Cut fiber detected by the electronic or passive seal
- ▶ Control of the fiber is done at the ground level, no more use to climb over the cask, except when an alarm is detected



Ultrasonic Optical Seal Bolts

- ▶ Two types of UOSB, depending on the detection seal, with connectors for electronic seals and with the fiber passing through for passive seals
- ▶ Seals are clamped on the inserts, remote verification done at ground level
- ▶ Ultrasonic bolt seals are designed to resist harsh environment (radiation, humidity, temperature, ...)



Success Story:

- ▶ 2011: Expression of needs & basic idea
- ▶ 2012: Preliminary design & in house tests
- ▶ 2013: Patent filed; positive results from external Vulnerability Assessment
- ▶ 2014: Field tests at Ignalina; authorized for Safeguards use (Category A) by the IAEA
- ▶ 2015+: Planned installation on more than 100 casks at Ignalina; joint inspection by Euratom Safeguards & IAEA



The Reading System:

- ▶ A light aluminum ultrasonic reading head easily transportable (water is used as couplant), an acquisition hardware & control software integrated in a waterproof rugged suitcase
- ▶ Once installed, the ultrasonic seals are controlled only if an alarm is detected on the electronic seals

