**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 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 tightened 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

**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

**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

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