Boron Contaminated Aluminum Scrap

What does it look like and what does it do?
Background....

• There are specialized, extruded products, called “neutron absorbing composites” (commonly called Boral composites) that are used as neutron absorbers in spent nuclear fuel storage systems and other nuclear applications.

• Boral is a composite of Boron-Carbide and Aluminum powder, and it is usually encased in an aluminum extrusion using a special process called “cladding”.

• It is the Boron (B) in this material that is the cause of great damage to those remelting aluminum scrap to make cast products.

• The resulting Boral extrusions have a resemblance to normal 6XXX series aluminum extrusions, but they exhibit some distinct features that identify them as Boral.
Why is the Boron so bad?

• Cast aluminum raw materials, most notably billet and rolling ingot, must meet specific chemical composition limits and also must be crack-free.

• High Boron levels render the resulting batch of metal as unsaleable because the maximum Boron content specified for nearly all aluminum alloys is very low. Boral contamination typically results in B contents that are 5x or even 10x the maximum allowable.

• Also, Boron contamination causes cast material to crack, by disrupting the grain refinement processes that cast houses use to control solidification and avoid cracking.

• Boron accumulates in melting and holding furnaces in the form of a heavy “sludge” that settles to the bottom. Dilution of the Boron takes several heats (or batches of molten alloy) resulting in multiple scrapped heats.
What does a typical “Boron Incident” cost?

• Due to the lingering nature of the Boron contamination, the disruption typically lasts for a day or more as a cast house struggles to identify the actual scrap pieces that contain the Boron and dilutes the Boron in the furnaces

• Each incident, depending upon the severity of the contamination, cost between $40,000 and $500,000 in lost production costs

• Over the last few years, the Eastern US billet producers have collectively accrued losses of over $2 million due to Boral scrap contamination

• If the Boral scrap can be traced back to the scrap suppliers, claims for recovery lead to legal costs when parties cannot agree on damage coverage
What does it look like?

• Aluminum remelters have been encountering Boral contamination since 2010

• The shapes that have been seen range from tubing, to flat bar, to scrapped billets and butt ends

• A collection of more detailed pictures is provided in the following pages
Tubing...can be shiny or dull. Fracture surfaces are “grainy” in appearance and there can be tearing on the inside of the tube.
Extruded Bar...Usually has a unique “Christmas Tree” tearing of edges and “grainy” fracture surfaces. Clad in 6XXX series aluminum
Butt ends and Billets...have a rough surface that is unique from normal 6XXX series
Boron Contaminated Tubing
Boron Contaminated Tubing
Boron contaminated Tubing
Boron contaminated tubing showing inside “tearing” that is typical of a Boral extrusion
Boron
Contaminated extrusion showing typical “Christmas Tree” tearing
Boron contaminated extrusion
Boron Contaminated Butt Ends
Boron Contaminated Butt Ends
Boron Contaminated Billets
Note to scrap yards, brokers, handlers...

- Any Boral scrap mixed in a load of aluminum scrap WILL cause substantial losses at a remelter
- Remelters have encountered Boral several times in the last 6 years
- This Boral scrap has driven remelters to improve their traceability practices to the point where we know who supplied each load and what it contained
- Remelters have no choice but to seek compensation from the scrap suppliers who have mixed Boron containing scrap in a load of aluminum scrap