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Report on Alloy Specification Development of Contaminants Limits

MetalTek International was requested to comment on the limits set for the contaminants, specifically Sulfur and Phosphorus, in its specification recommendation to PPPL for the NCSX program. This is the result of that investigation.

In review of the data and efforts in the 2.1.2 Task (Alloy Selection) under the prototype contract, several items were of note relative to the alloy chemistry development:

- 1.) In the onset, Alloy#1, a less alloyed variant of 316ss, was considered; however, the concern within PPPL and MetalTek was the effects of water quenching on the alloy during solution anneal (e.g. dimensional control and residual stresses).
- 2.) The limits for P and S in the Alloy #1 were set to comply with standard CF8M (cast "316ss") limits of 0.04% maximum for both.
- 3.) In order to eliminate water quench, a second alloy was funded under the scope of the 2.1.2 Task. This alloy was successful and has been referred to as "Stellaloy."
- 4.) The limits for P and S in the Alloy #2 were set to comply with standard limits for CF8M, again 0.04% maximum.
- 5.) Heats were made for each alloy, with both P and S well below the 0.04% maximum limits; however, one heat showed P above the 0.015% ultimately recommended.
- 6.) Based on review of the testing, MetalTek International Research recommended a chemical composition range for the ultimate 2.1.2 task. This range incorporated restrictions on the P and S at 0.015% maximum limits. Insufficient review of this recommendation against historic chemical analyses and those reported in the task was performed, resulting in the recommendation to PPPL to use the lower limits.

In essence, insufficient review of available data outside the recommendation of the MetalTek International Research group resulted in the proposal of a specification beyond the limits of the planned production processes.

Joe Edwards/Chuck Ruud

Two handwritten signatures are present. The first signature on the left is a stylized, cursive signature that appears to be "JE". The second signature on the right is a more fluid, cursive signature that appears to be "CR".