Overview
The ArcelorMittal plant in Steelton, PA specializes in the manufacture of railroad and crane rail. To diffuse the hydrogen left in the rails after hot rolling, the plant utilizes eight controlled cooling boxes constructed from metal sheeting, lined with an insulating material, and heated through the use of a gas burner. However, the current boxes are in poor condition and difficult to perform maintenance on.

Objectives
The main goal of the redesign was to make it easier and safer for maintenance to be conducted on the boxes. The redesign also needed to improve the durability of the boxes and the efficiency of the burner system. Finally, an automation system needed to be created to adjust the temperature within the cooling boxes and provide feedback on the gas usage of the burner.

Approach
- The team visited the Steelton Plant to look at the current cooling boxes and discuss the goals and expectations of the redesign with the sponsor. After the site visit, the team used the information from the sponsor to compile a list of customer needs and project requirements.
- An external search was conducted on patents and existing products for each of the main areas of focus of the re-design: cooling boxes, burner systems, insulation, and automation.
- Sub-systems and design requirements were identified for each of the main areas of focus so that concepts could be generated. Pugh scoring charts were used to rank the concepts of each category based on their ability to fulfil the list of customer needs. The highest scoring concepts were combined into the system level design.
- CAD models of the design were created and updated as the project progressed. The automation system was mapped out with a logic flow chart.
- Structural and thermal analyses were conducted to verify the effectiveness of the design. The automation program was written, reviewed and debugged to ensure it functioned as needed.
- A scaled down prototype of the final cooling box was created to visually demonstrate the features and functions of the design.

Outcomes
- The design reduced annual gas usage by 45%. This equates to an annual savings of $19,500 in gas costs.
- The thermal analysis concluded that the burners take about 1.5 hours to heat the boxes to the desired temperature. Once the burners are turned off, the temperature fluctuates no more than 64°F over an 18 hour period.
- The automation system has the ability to semi-automatically adjust temperature based on the desired operating range, start and stop the burner with automated changes to the gas valve position, and shut down the system should an emergency occur.