Procedures:

Figure 2.1

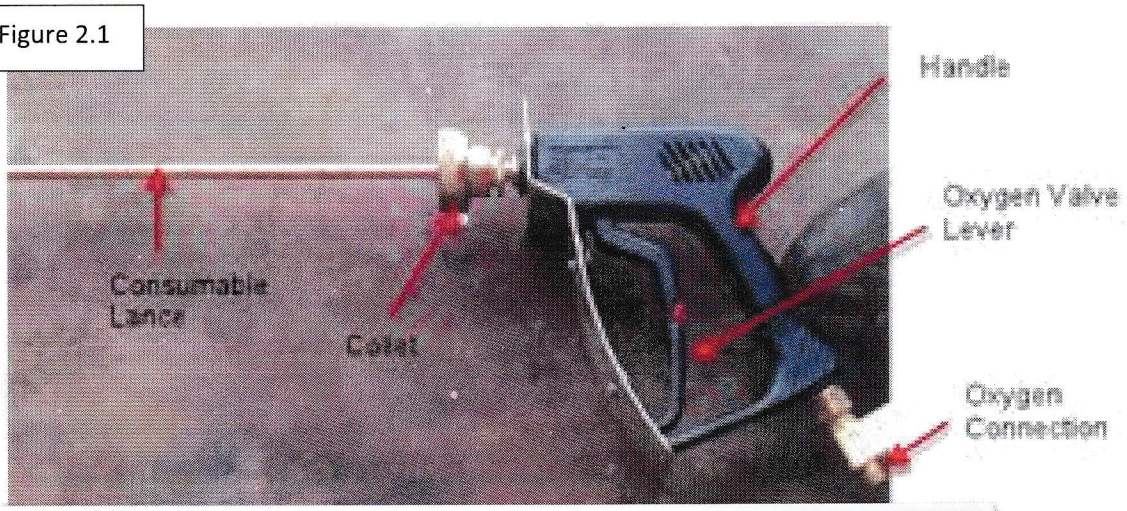

Figure 2.1 above shows the torch handle set up for a thermal lance. This handle and lance would be connected by a hose to an oxygen bottle that when sent through the lance at high pressure when the tip of the lance has been heated creates the reaction.

1. Thermal lance was attached to a pure oxygen source that was regulated to 60 psi.
2. The lance was installed by first sliding the lance into the collet in the handle and was locked in place by rotating collet clockwise.
3. The end of the thermal lance was heated with an oxy-fuel torch until it was bright orange hot. Caution was taken in heating the end of the lance so not to only heat one side so it would light properly.
4. The oxygen valve was open as soon as the end of the lance was ready.
5. The steel plate was cut in two with the lance, the cut was made lengthwise.
6. The aluminum plate was cut in half with the lance, the cut was made widthwise.
7. One hole was burned through the cinder block and then one hole was burned through the brick.
8. For each material that was cut, one team mate was used to cut it
9. Each lance was not allowed to be burned past the black line at back of the lance.
10. As each lance was burned down to the black line they were removed and replaced by turning the collet counter clockwise to remove the lance then a new lance was inserted and the collet was tightened again and then ignited like in steps 2, 3, and 4.
11. Pictures were taken of the race.

Results:

Figure 2.2

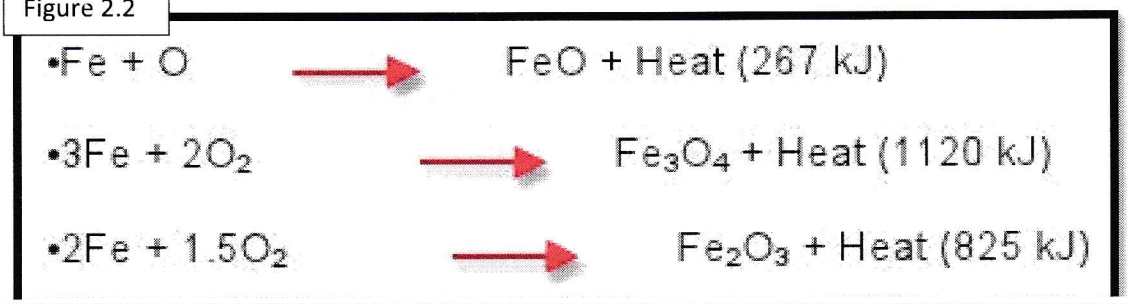

Figure 2.2 above shows the formula for heat generation for a thermal lance. On the left is the composition before the reaction has been activated and on the right is after the reaction has been completed.

Figure 2.3

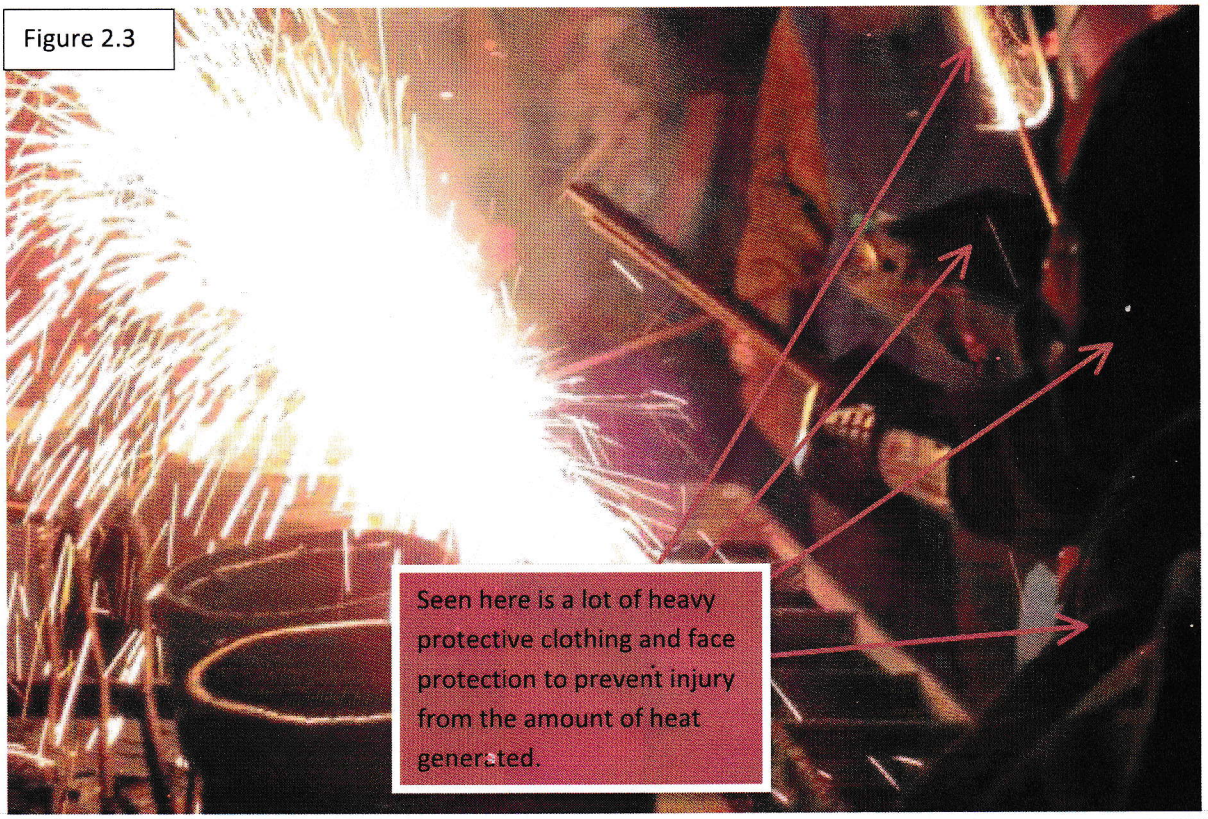

Figure 2.3 above shows the thermal lance in action, as you can see in this picture the oxidizing reaction is incredibly violent. With temperatures reaching 8000^0 Fahrenheit to 10,000^0 Fahrenheit the thermal lance can burn through just about everything. You can get an idea about how much heat is generated by the amount of protective gear the operators are required to wear.

Figure 2.4

Figure 2.4 shows how much material is melted and oxidized from both the material being cut and from the lance itself.

Discussion:

1. **Describe how the thermal lance generates heat:**

A thermal lance generates heat much the same way as an oxy-fuel cutting torch. When the end of a thermal lance is heated to a bright orange color and oxygen is sent through the lance at high pressure an oxidizing reaction occurs generating a very large amount of heat.

Figure 2.5

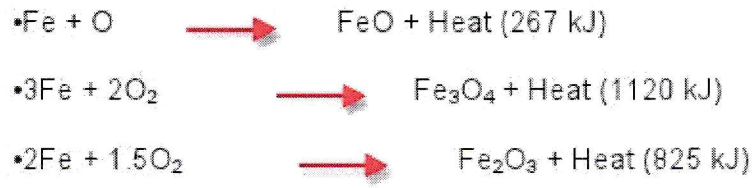

Figure 2.5 above shows the reaction as it is before the reaction is initiated on the left side of figure 2.5 to the result of the reaction used to calculate the amount of the heat generated in Kilo Joules on the right of figure 2.5.

2. **Describe why a thermal lance is good to be used in demolition:**

Thermal lances are a perfect tool to use in any large demolition job and not just because of the large amounts of heat generated that can cut through just about everything. A thermal lance is relatively easy to use; it is pretty much just plug and play. As well as the ease of use and the ability to cut through just about everything the thermal lance is also very portable for the amount of demolition it is capable of and along with the relatively low cost for what it does a thermal lances are a very good tool for any large demolition project.

3. Describe how the chemical reaction of thermite and thermal lance differ:

A thermite reaction is where the oxide in the thermite is reduced as a result of having it oxygen pulled out of it, eventually giving the thermite its own source of oxygen. With the thermal lance the oxygen used to generate its reaction is acquired from an outside source like a bottle of oxygen. Also in thermite the element that becomes oxide and floats to the top of the molten metal as the reaction occurs does not have much of a purpose other than maybe protecting the weld metal after the reaction is complete. The thermal lance on the other hand only uses oxidation as the mechanism for the reaction and cutting like with an oxy-fuel torch.

4. **Describe how the steel and cinder block react differently to the thermal lance:**

The thermal lance race had its ups and downs, but when it was time to cut through the brick and cinderblock a clear difference became apparent. The oxygen lance cut through the steel and aluminum sample quickly and easily. This is because when the oxygen lance was lit and began cutting through the metal it was not just using the extreme amount of heat to cut with, in addition to the heat a rapid oxidation of the metal samples was also occurring where the lance was aimed. This was because the reaction that the oxygen lance uses is the rapid oxidation of the metal within itself, so when you aim it at a piece of metal" like in the race" you are extending that reaction to the metal being cut. When it came to the brick and cinderblock however that oxidizing reaction cannot be extended to them, so the only cutting action in their case is just the extreme amount of heat generated by the oxygen lance itself.