and what could be found in his references or what we would consider an authoritative reference. So, again, there's a need for discussion as to which value is appropriate to use in their evaluation of risk.

So if we go on now to their calculation of residence time. The Applicant wants to conceptually picture the fire as we have a burning pool here, evaporation occurring, air coming in at the bottom.

So essentially we visualize this as a pipe, so the vapors are flowing up, the hot gases up and out. So the-question is in order to calculate residence time, you must first calculate the mass flow rate.

The Applicant came up with in its estimate of value 2,388,000 (sic) and so forth kilograms per hour, but then we went back and compared the flow rate that they used in the flame temperature calculation and we found that the mass flow rate is only 539,000 kilograms per hour.

(Mr. Brown's overhead transparency

indicated 1,388,000, but he said 2,388,000 according to my stenotypy notes and the audiotape.)

So this inconsistency in mass flow was not discussed in the application, and one has to wonder which is the more appropriate value, and so let's proceed to the next one.

MR. SHAPIRO: If I may interrupt. Why is that important?

MR. BROWN: Why is it important? All right. We'll go back to that.

Maybe I should comment on that later, but the mass flow involved in a flame temperature compilation, if the mass flow had been higher, the flame temperature would have been lower. And so if you're going to -- simply a correct mathematical solution to these problems would have consistent values for these quantities.

So what you're faced with, you wonder why was a low mass flow chosen here and why is a higher one chosen here. I will just say that it leads -- it just leads to inconsistent results.

Now, looking now at how the Applicant calculated his mass flow, he goes to a reference Peters, which is a chemical engineering student text, and he takes out an equation for turbulent flow inside a pipe, HT is equal to this value, correctly cited, and then he also takes an equation for free natural convection of gases and the heat transfer coefficient is equal to this. That again is correctly quoted.

And then the Applicant equates these two, and then by doing that, you're able to solve for G from this expression which is the mass flow.

The problem here is if you go back to this reference, there's no discussion about a possibility of equating these two, and the Applicant didn't present any discussion of how this might be, what the basis for this might be. And so if you're going to present something like this, it would seem that there should have been perhaps a mathematical derivation showing how this is possible or some experimental data showing this is possible, but that kind of information was not in the record.

We can go on to the next. I've already discussed this point. Based upon general heat transfer concepts, you might write an equation for QT, the total heat flow rather than heat transfer coefficient.

Total heat flow toward the wall of the pipe we envision might be equal to the total heat flow absorbed by the air, but as I put here is not self-evident. There must be a demonstration to show that you could equate the heat transfer coefficients.

We'll go on to the next. The next question would be what should be the right air flow or mass transfer, mass flow and the calculation.

So we went back to the reference 2 and we note that both the Applicant and the reference start the calculation using the same heat balance for flame temperature in the flame temperature calculation.

Then when it comes time to solve the

problem, the Applicant uses the ratio of 14 times the fuel burn rate as the rate that air flows into the system, which is the stoichiometric amount of air. That means that is the air that's just sufficient for complete combustion of the material.

So if we look at reference 2, first of all, we note that the equation for air flow into the combustion zone is about three lines long, so I didn't go any further with it. I went on to the tabulated results. We've already seen some of these temperature data.

Again, the temperature decreasing as diameter of the flames increasing, but from data in the references, Table 4 and 2, you have both air flow and fuel flow, so you can calculate the ratio.

We see the ratio is about 18 to 22, increasing in this example with pan diameter and here -- ignore this value, it's increasing, but again, it's in the order of 20.

So we can say at least the reference

is using a larger air flow than the Applicant did, and there's no discussion of a difference there.

Next we'll look at the calculation of the concept of destruction and removal efficiency which involves two steps, first calculate a k which is a rate constant for the rate of the combustion's reaction.

And we took -- we noted, first of all -- and the Applicant has prepared a table which has k values for all the components of hazardous waste fuel.

We noted for acetone, he calculated this k value, and we were at that point in our reading thinking that these were the inputs to arrive at this value.

The A is from the same table, the Ea is from the table. This is a gas constant. The flame temperatures we use, 2108 is the flame temperature the Applicant has estimated previously. We arrive at a k value of 422 versus their k value which is 7.3 times 10 to the minus one.

So if we go to the next one. We did

that calculation for all the values in that table, and we note that in every case the k value that the Applicant presents in the table is much less than the value that we calculated.

So then we worked the problem backwards to see what the temperature could be used in the equation to arrive at the Applicant's answer, and we found it to be 1000 degrees K.

So the next step is to reread what the Applicant has presented to see if there's any indication as to why suddenly they are using 1000 degrees instead of 2108 degrees. And the only references to flame temperature would be on page 18, assume the flame temperature will be 2108 degrees. And then on pages 18 and 19, again when we're into flame height and mass flow calculations for residence time, we're using the 2108 degrees K. So there's no discussion in the record about using 1000 degrees K.

Proceeding to the next step of the calculation of destruction of removal efficiency, the k value we just calculated is this value. The T is the dwell time which is based upon the Applicant's estimate of the flame height and the total mass flow that the Applicant has calculated. So that value came out to be 3.8.

So if you use these -- first of all, we noted if you use this dwell time and if we use the k value you get with 2008 degrees, then the DRE for everything would be 1, you expect total destruction.

Then we redid the calculation using the k values the Applicant had in the table and the dwell time of 3.8 and we get the Applicant's DRE values.

The important point here is to note that we're calculating a DRE, but we're using -- in one step we're using 1000 degrees K and another step we're using 2100 degrees K. So there's inconsistency of what the value of T should be in this calculation. It should be the same value for both steps of the calculation.

Now, the next step to do this