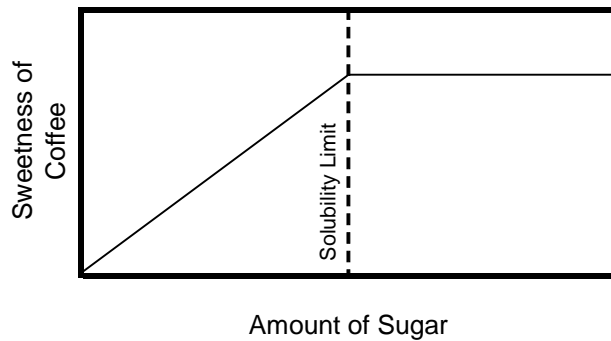


Question #13:

The value of RBCsi (vapor intrusion into indoor air) for generic gasoline goes from 94 ppm for the residential scenario to >MAX for the occupational scenario. Why does this RBC increase so much when the occupational exposure is not that much less than the residential scenario?

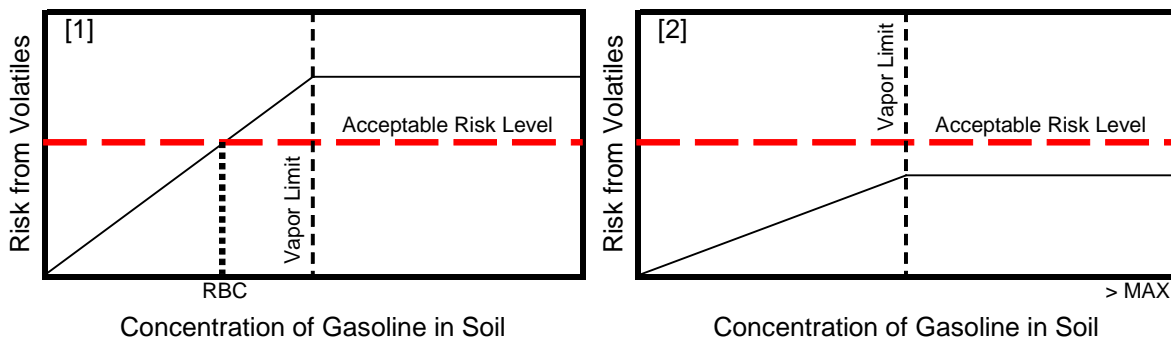
The generic gasoline RBC for a residential scenario by the leaching-to-groundwater exposure pathway (RBCsw) is 31 ppm. The RBC for the corresponding occupational scenario is 130 ppm, about four times higher. The generic gasoline RBC for a residential scenario by the vapor-intrusion-into-buildings pathway (RBCsi) is 94 ppm. With this pathway, however, the RBC for the occupational scenario is listed as ">MAX," meaning that it is a very large number, such as 100,000 ppm or more. Why does the RBC increase so much when moving from the residential to the occupational scenario for RBCsi when it doesn't for RBCsw?

Answer: The answer has to do with the way that the system behaves when it changes from three phases to four phases. To use a commonplace analogy for this change, think about what happens to the sweetness of a cup of coffee when you add more sugar to it. As you go from one teaspoon to two teaspoons you can easily tell that the coffee tastes sweeter. Adding a third teaspoon will make it even sweeter. But, you will eventually reach a point where adding more sugar will not make the coffee sweeter. This is because the added sugar can no longer dissolve (you have reached its solubility limit) and it sits on the bottom of the cup where it does not contribute to the sweetness of the coffee. A graph of such an experiment might look something like the following.



In a similar manner, when a petroleum product enters soil or any other porous medium, some of the lighter components will volatilize into the pore space. This, of course, is the fraction of the product that could eventually make its way up into an overlying building. If more petroleum enters the soil, more will volatilize, increasing the concentration in the pore space and ultimately increasing the concentration that could enter the building. You eventually reach a point, however, where adding petroleum will not increase the amount of volatiles in the pore space. The additional petroleum cannot volatilize and simply forms a separate petroleum phase.

If the vapor concentration from the gasoline-contaminated soil reaches the acceptable risk level before it reaches the vapor concentration limit, the RBC is simply the soil concentration where the vapor is right at the acceptable risk level (see figure [1] below).

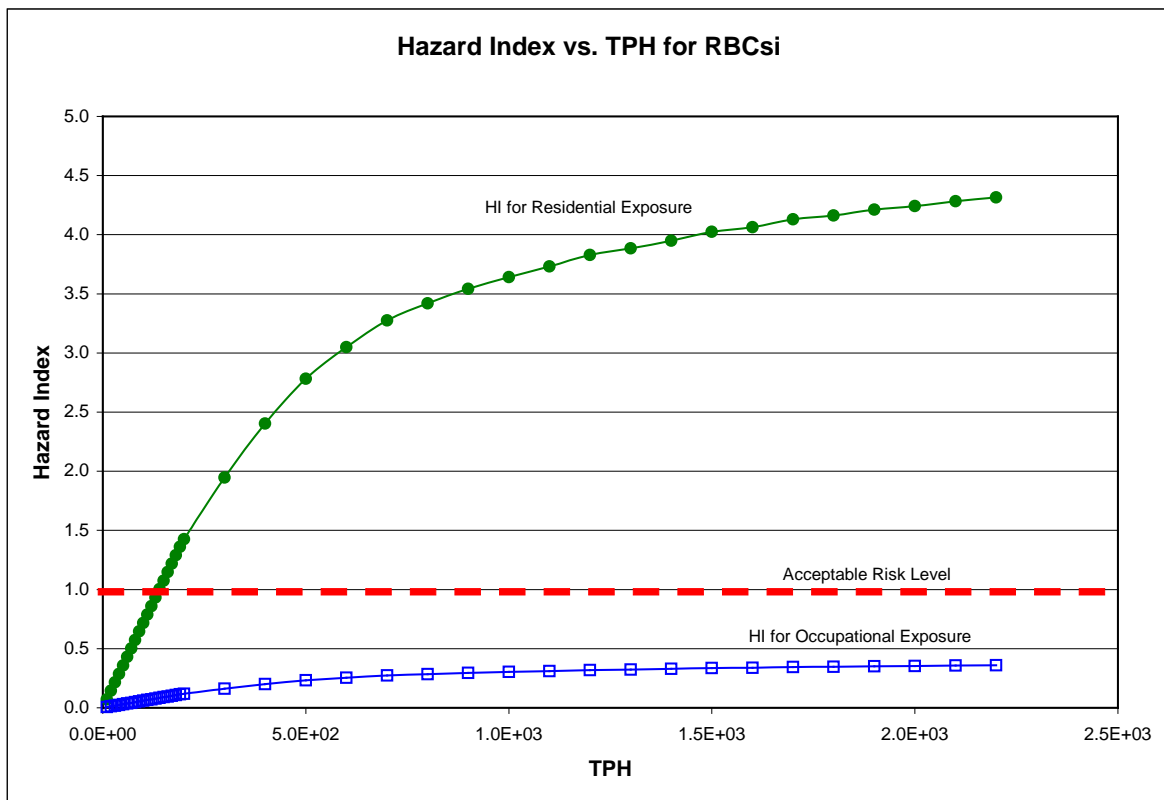


Question #13:

If, however, the vapor concentration from the gasoline-contaminated soil reaches its concentration limit before it reaches the acceptable risk level, then the risk level will never be “unacceptable”¹. Therefore, the soil concentration can be as high as possible and the risk from this exposure pathway will still be acceptable. This is denoted by “>MAX” in the RBC table and is illustrated by figure [2] above.

In the case of the generic RBCs for gasoline, the RBCsw exposures for both the residential and occupational scenarios follow the pattern illustrated in [1] above. For the RBCsi exposures, however, the residential scenario fits case [1] and the occupational scenario fits case [2]. That’s why the occupational value is only a little higher than the residential for RBCsw but is much higher (>MAX) for RBCsi.

The actual data for the two RBCsi scenarios are plotted in the graph below. The point where the hazard index (HI) for a residential exposure (●) crosses the acceptable risk level (---) corresponds to the residential value for RBCsi, which is 140 ppm in this case. Since the occupational exposure (□) never crosses the acceptable risk level, there is no unacceptable concentration for the occupational scenario. Therefore, the value for RBCsi occupational is simply listed as “>MAX” in Appendix A.



(Note: In order to more clearly illustrate the process discussed in this answer, the graph above shows only a small portion of the full range of TPH data.)

¹ Notwithstanding the presence of NAPL, and direct contact with NAPL is always considered unacceptable.