An alternative view of human health risk assessment
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09/09/02

I have an alternative view of human health risk assessment. I hope in the next 15 minutes to give you something to think about when you are reviewing the risk assessments at Alameda.

I think that human health risk assessment is misused in EPA's Superfund program. Why?

Because the scale of the method mismatches the scale of the problem. Risk assessment is too crude of a tool to be used as a basis for cleanup decisions at small sites. Recall the topic of significant digits in math...the result of a calculation should not exceed the precision of the original measured value. Risk assessment is based on some very crude estimates of toxicity and exposure. The estimates really only begin to mean something when applied to very large areas and populations – say air pollution in a major city or the effects of second-hand smoke on the US population as a whole, or arsenic in drinking water nationwide. The cleanup decisions at military bases happen on a much smaller neighborhood scale. Yet, the assumptions that underlie the risk assessment methodology are not appropriate for this smaller scale.

That being said, I do believe that risk assessment can be a useful tool for evaluating small sites. The methodology can be used to rank potential hazards and zero in on the ones that have the highest likelihood of causing harm. The method stops making sense, though, when the risk numbers are used like they mean something in the outside world.

Risk assessment cannot prove that an area is safe...it can only give us an inkling that one area is safer than another.

Remember: **the modeled result is not reality.**

> Risk assessment is a model … the outcomes are not real any more than a painting of a tree (even a really good one) IS a tree.
>
> > Like painting, modeling relies on making simplifying assumptions in order to illustrate a point.

Risk assessment is NOT an exact science

- All the input data are crude estimates
- Many unknowns
- Many opportunities for discretionary judgements
- Ignores complexities (such as synergistic interactions)
- Errors multiply

Therefore, in my view, the risk assessment model is only useful for:

- Normalizing chemical concentrations
- Finding and ranking potential hazards
- Finding remedial actions that give the biggest bang for the buck
- Interjecting some discipline into cleanup decision-making process

How might my view of risk assessment work within EPA's the risk assessment schema?

- Baseline
  - Rank the chemicals of concern
  - Rank contaminated areas from worst to best

- Risk management
  - Determine cost/benefits for potential actions
  - Figure out where you can get the biggest bang for your buck

- After-action
  - Identify and track remaining issues

As you know, EPA does not use risk assessment in the way I've described -- that is to rank, prioritize, and track actions. Instead, explicit numbers are reported that purport to represent a statistical risk due to estimated exposure.

<u>The Consequence of Believing Too Much in the Numbers</u>

One of the consequences of believing too much in the numeric outcome of risk assessment is the temptation to manipulate your run of the model to achieve a desired outcome. This is exactly what we've seen happen at military bases. One of the most common methods of manipulation is to intermingle risk assessment with risk management.

For example:

- Screening "background" concentrations from the baseline risk assessment
- Excluding soil under paved areas and buildings from sampling, or risk analysis because there is no current exposure pathway
- Excluding groundwater data from the risk assessment because drilling wells is not permitted in the local jurisdiction
- Assessing risk only for industrial reuses, because the site has always been industrial.

The fair way to play this game is to assess all baseline risk THEN to look at ways to manage site conditions in a health- and environmentally-protective way.

Broken Pathways: institutional controls and risk assessment

Another common trick is to claim that baseline risks can be mitigated by restricting access or use of a site. The claim is that an institutional control (a law or restriction) will break a pathway of exposure and therefore reduce risk.

Unfortunately, the risk that the institutional control might fail is NOT addressed in the typical risk assessment. Instead it is assumed that the institutional controls will work and keep working as long as the contamination exists. In other words, the estimated risks presented to support this type of remedial action do not address the robustness, effectiveness, or permanence of the institutional control.

I could talk for a long time about institutional controls. I won't tonight but I will leave you with this: there is very little evidence to suggest that institutional controls work, even over the short-term.

The Mare Island Example: a medical school located at Mare Island wanted to rent some apartments at the base in which to house students. Lennar had control of the property. DTSC granted Lennar permission to rent the buildings to the university to use as apartments on the condition that nobody under the age of 18 would occupy them (due to lead hazards). The university was to report this condition to the individual students. Not more than a year later a student reported at a RAB meeting that families (with young children) were living in the apartments. Somehow the restriction had been forgotten.

Acceptable risk management range" Acceptable? To whom?

EPA uses the general 10^{-4} to 10^{-6} risk range as a "target range" within which the Agency strives to manage risks as part of a Superfund cleanup. EPA generally will not require cleanup when risks are less than 1×10^{-6}.

Somehow "target range" has changed to "acceptable risk range" in Navy documents.

The Navy cannot make the claim that their estimated risks are acceptable to anyone but themselves. What is acceptable to the Navy (or EPA) may not be acceptable to you. Don't be lulled into complacency when you see this term...instead treat it like a red flag.

As a reviewer of a risk assessment you need to figure out how well the assumptions used in the assessment match your community – your habits, demographics, dreams, etc.

Also, don't be lulled into complacency by the claim that a site risks are (or will be cleaned to) the magic 10^{-6} risk level. Dig into how that level was achieved.

Equal risks are not Equal

Remember that estimated risks cannot be compared to each other unless ALL of the input assumptions are the same...

- a 10^{-6} level cleanup at Hunters Point will not necessarily be the same as a 10^{-6} cleanup level at Alameda.
- 10^{-6} residential is not the same as 10^{-6} industrial

Rather than compare risks…compare the concentrations of each chemical that equate to the "equal" risk. If the chemical concentrations differ then so do the assumptions were used to compute the risk.

Other Common Tricks

Here are some other common ways in which risk is underestimated:

- Not reporting cumulative risk (required but often ignored in baseline risk assessments)
- Ignore important pathways of exposure (current or future)
- Average chemical concentrations over too large an area, thereby hiding hot-spots
- Not calculating risks when there are no toxicity values in the EPA database (pretend no information = no risk)
- Set high "background concentrations," and then screen samples out of the risk assessment process
- Ignore "non-detects" even if the detection limits are really high.
- Assume that pavement, fences, or other barriers will not allow contact with contamination (variation of ignoring pathways of exposure)
- Assume that industrial sites will always be used for industrial purposes.

Look at the depth of the cleanup too…we've seen "surface" defined anywhere from 6 inches to 10 feet.

Start the review process early – at the work plan stage

In my opinion the most important part of the risk assessment to review is the workplan.

This is true of all parts of the RI/FS process. The workplan determines how the study will be carried out, and how the data will be collected and evaluated, and what assumptions will be used.

Be sure to check all draft reports against the work plan. Did the Navy do what they said they would do? You'd be surprised at how many times I've found major discrepancies.