Clinton Landfill, PCB disposal Risk Communication Statement

By S. M. Johnson
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The level of protection afforded by the CWU to drinking water resources is such that standard risk assessment approaches are not meaningful. So many conservative assumptions have to be made in order to develop a hypothetical exposure pathway for assessment purposes that the results of any risk assessment are not as important as number and magnitude of conservative assumptions used in creating the hypothetical pathway. The hypothetical pathways have the potential to draw widespread interest and tend to dominate communications and the assumptions are lost in the background of details. Hypothetical pathways of expectable interest include aquifers that are found anywhere near the CWU.

Despite being located near the CWU, the Mohamet Aquifer is fully isolated. It is isolated from the outside of the CWU by natural artesian conditions and the 170 ft. thick Large Area Clay Pan, made of silty clay tills with thin permeable units of silt and sand. A hypothetical exposure pathway that includes water from the Mahomet Aquifer is not a reasonable pathway. The basis for it not being a pathway rests in a weighing of reasons pro or con. Estimates of the protectiveness of the CWU, monitoring methods and the natural properties of the site upon which it is located may only be bounded by establishing a common unit of measure and measuring everything in terms of that unit.

The geosynthetic liner makes a reasonable unit of measure. Failure analysis shows a liner is always an impediment to flow even under the so-called "bath-tub" scenario of concern supposedly caused by cap failure. The liner, even under such worst-case saturated soil conditions can be relied upon to reduce the concentration of leachate that escapes by an order of magnitude.

A tabulation of conservative assumptions in the design of the entire facility can be made by assigning one membrane-equivalent for each order-of-magnitude type assumption present in the application. By using TSCA regulations where possible and ignoring complications whenever they lead to situations that cannot be reasoned through in a simple way, the Mohamet Aquifer groundwater located 170 feet below the cell is protected from PCBs in the landfill by the equivalent of 25 to as many as 50 geomembranes that are 30 mils thick…following a TSCA rule of thumb where 4 feet of natural clay equals one 30 mil liner and another rule of thumb where one liner is capable of reducing the concentration of leaked liquid by an order of magnitude via the "pinhole effect" described in numerical evaluations of liner performance.

Following the consequences of such an accounting and assuming that risks follow a multiplicative rule means that a 1% solution of anything, table salt trying to escape 25 liners, for example, would become roughly $1x10^{-25}$% were it to reach the

Mohamet Aquifer. Salt at that concentration is would be undetectable. Similarly a 100% solution of anything would be reduced by such an astronomical amount, 1 x 10^{-25} , that the result is the same, effectively zero. Even if the risks are combined unfavorably such that 25 liners reduce concentrations 25 times better than one will, the net result is a reduction of concentration of any solute attempting to escape the landfill first by a factor of 10x at a pinhole and then by another 25x because of the presence of another 24 liners "below the pinhole" that presumably pass liquids. That would result in a reduction of 10x combined with another 24x to give a final 240x reduction. One ppm of anything would then be reduced by 240x to a concentration of approximately 0.004 ppm (4 ppb). Therefore, given that PCB concentrations in leachate are realistically at the 0.5 ppm level and escaping liquids would be between 2 ppb and trillionths of a quadrillion. It is not reasonable to claim a hypothetical deep Mohamet exposure pathway poses a meaningful risk to the aquifer much less to users of it.

Furthermore, any hypothetical wells drawing from the Mohamet Aquifer right at the landfill itself are not only protected by the hypothetical 25-50 liners but they are protected by time and motion. Because the Aquifer is artesian and the direction of groundwater is up, not down for the last 100-140 feet of the total 170 foot thickness. Such a pathway segment would be both incomplete and slow. For such a path to be considered complete, the rules of how groundwater and PCBs move would have to be re-written as part of a molecular diffusion system. Conservatively assuming that there is a meaningful downward flow path, contaminant movement would be slow. Time-of-travel would be long…thousands to tens of thousands of years for a molecule to move straight down on a shortest path assumption.

Building upon the hypothesis of downward movement as chemical movement against the static pressure of the Mohamet aquifer, migration of PCBs would proceed at the pace of random molecular movement. Because of the problem of finding enough PCB molecules to make concentration-based migration headway time of travel calculations become unrealistic. Evaluating the other path, a water flow scenario, requires the conservative (but unrealistic) substitution of a widely quoted soil-water parameter, permeability (1 x 10^{-7} cm/sec) for the velocity of PCB migration. Under those circumstances, a hypothetical particle would move orders of magnitude faster than it should. Calculations indicate a water based-time-of-travel of 2000 years to go 170 feet, the distance down to the Mahomet. Ignoring all the assumptions that went into the calculation, there are even more that would have to be overlooked. They include protective measures that operate at the molecular level and at the water flow level. Such protective considerations include the reality of include thin sand seams that divert and dilute flow and the presence of organic material in the soil that traps PCB molecules, much as in the "Pollute" based groundwater model calculations. But that is not all.

Just making it to the Mohamet is only part of the hypothetical pathway issue. If a particle makes it to the Mohamet, it would become lost in a huge volume of water moving along relatively quickly in an unpredictable direction. A PCB particle

entering the Mohamet would not necessarily find its way to what is called the Mahomet Bedrock Valley. It would not necessarily even flow in the direction of known municipal wells of concern…those within the 10 mile groundwater protection radius around Clinton. State mapping and drilling data shows local bedrock topography in the area and there is a thinning of the Mohamet aquifer under the CWM. The thinning extends for several miles and appears to pinch out against the bedrock high only a mile from the CWU. The main course of Mohamet Aquifer flow divides approximately a mile east of the landfill. The CWU is not located above the Mohamet Bedrock Valley Aquifer. As a result, a hypothetical particle moving straight down could be diverted away from the Mohamet Bedrock Valley Aquifer. Flow in the area of the basement high is probably irregular, curving around bedrock obstructions. Because water table, rock type and bedrock topography indicate that deep aquifer flow below the CWU could flow in several directions, the path of a hypothetical PCB particle is not predictable at this time. It might easily flow due west down the Kenny Valley branch of the Mohamet Aquifer.

Similarly, the shallow groundwater pathway in the Glasford Formation where water from within the Large Area Clay Pan reaches shallow domestic wells is not complete. Wells within the Glasford Formation are not downgradient of the CWU and are probably not downstream of the CWU either. Tests to demonstrate actual "stream flow" were not done and they seem premature given the extent of what is known. Study of water sands and wells in an area of about 36 square miles and development of a Geographic Information System for the area suggests that the water in the Glasford Aquifers move south…toward Salt Creek. Flow from below the CWU does not go in the direction of any wells on the north side of Salt Creek. Shallow or deep wells south of Salt Creek are protected because Salt Creek is a significant hydrogeologic barrier. Groundwater flow in the Glasford Formation is dominated by Salt Creek Valley.

A third issue-of-concern exists but it is not a PCB flow path issue, it is more a topography issue as listed in 761.75(b)(5). Evaluation shows the risk is acceptable even on a geologically meaningful time basis. It is the problem of erosion and the long term threat it poses to the integrity of the landfill itself. Because the landfill is built partially upon the slopes that lead to Salt Creek Valley, there is reason to be concerned that Salt Creek could erode those slopes at some indefinite time in the future. Evaluation of the style of erosion indicates, however that Salt Creek is not actively cutting new valley. Salt Creek is an underfit stream many times narrower than the valley. The stream meanders sinuously in an effort to keep up with sediment load. It is not making its own sediment load, gullies nearby are providing sediment to the valley. The valley system is typified by small and occasionally medium sized branched side gullies that are effectively eating away at Clay Pan #1. The main threat to the slopes of Salt Creek Valley (and to the site where the CWU is to be located) is from the widespread development of gullies throughout the drainage system. There is extensive gully formation in the area around the CWU-site. Drilling results indicate that the gullies are following thick sand bodies. They develop where groundwater can breach the surface and speed up erosion. Evaluation

of gullies and sand bodies on-site shows that the CWU is to be built in a relatively favorable location where shallow sand zones causing the gullies are thin or missing. Furthermore, analysis shows construction of the CWU will block shallow groundwater flow if it exists and so prevent its reaching a slope and causing erosion. The slopes will be protected by the cells. There will be a groundwater "shadow" downstream of the cell that can be made complete. Other cells, if constructed will do the same. If not adjacent cells are not constructed, groundwater cutoff walls will cure the problem.

Given the 500 feet of gentle slope that protects the cell from the uncertainties of stream flow on the floor of Salt Creek Valley, given that the floor of the CWU will be at the same elevation of Salt Creek Valley and given the 1000 feet of valley floor that protects the slope from an underfit stream, there is reason to believe that the forces of stream erosion are dominated by slope erosion and that the stream will stay within its current valley and play a secondary role to slope erosion in the future of the valley. If slope erosion processes are stable in the vicinity of the cell, the CWU will probably outlast everything else in the area including Clay Pan #1. If so, it will become a stable isolated erosional remnant that will stand 50-100 ft above Clay Pan #1 and dominate the countryside in the far future.