Looking Deeper Into Groundwater Contamination

With all the recent publicity about crude oil tank cars either leaking or involved in railroad accidents, it might be worth your time to learn a little more about both railroad track construction and how surface spills migrate to other areas. Understanding how your spur track is made or how “minor” releases at your facility migrate may help you in avoiding the consequences of remediation and governmental fines.

Nearly all leaks, overflows, broken lines/hoses etc. involve chemicals/oils that should not get into our streams and drinking water sources. We’ve recently read about Toledo, OH’s water supply, or Charlestown, WVA loosing their drinking water for a few weeks. The legal ramifications of these “Oops” events will definitely affect the companies’ bottom line but some of the damage may not be “seen” for many years.

There is a frequent misunderstanding about the elevated berm on which the rails are laid. First of all, let’s do some math on a railroad tank car. Many of them weigh in at 200,000 lbs. and are supported on eight steel wheels that touch the rail surface with no more than 3 square inches of surface each. This means that each point of contact between the wheel and rail is approximately, 8,500 psi. During the movement of a tank car, this hammering takes place four times for each length of tank car so you can imagine how many “hammerings” a steel rail takes from a passing train. The faster the train moves, the more frequent the “hammering”.

Though a bermed railroad spur track may appear to be a formable “dike”, closer examination shows just the opposite composition. Even on firm soil, (i.e. 3,000 psf) the railroad contractors cut down to the “packed” subsoil which is often, packed clay which is usually impervious to water. Often times, railroad “cuts” for spur tracks are made through native layers of either gravel, or other geologic deposits that have been there since the last glacial age 10,000 years ago. These irregular deposits are actually buried rivers beds and usually meander around but have general slope toward established present river valleys.

When bulldozers make these cuts and engineers evaluate the weight baring capability, the amount of gravel backfill is specified. This may vary from about a foot of depth when built over rock layers, to often over four to six feet of loose, open gravel backfill in areas of “soggy” soil or locations subject to heavy surface drainage. This ballast crushed rock is deliberately selected to NOT have a lot of “fines” or small granular clay which might settle and close the porosity of the backfill.

Railroad ballast serves a number of purposes. Primarily, the loose gravel absorbs the fore mentioned hammering from the wheels passing over the rails. Since older and original railroad ties were creosoted wood pieces, the loose rock below them allowed rainwater to quickly drain away from the wood and so greatly reduce the rotting of these ties. These ties spread the weight out over many square feet of ballast to absorb the passing weight.

Around industrial plants there are many locations where spills are likely and these area should be isolated using paved or concrete slabs and impervious curbing and then using “sluice gate” drainage points which can be shut quickly during more “dangerous” operations like transloading from truck-to-rail (i.e. unloading crude oil from tanker trucks returning from a remote well site storage tank) or where a plant’s commodities are delivered for process use. Often vehicle refueling areas have overflows or large transfer hoses are discarded out on the ground and drain out. Other “spill” sources may be set up by ignorance of thermo-expansion. i.e. loading a tankcar too full in North Dakota at a temperature of 40º and then when it gets south to Houston and the temperature is now 75º, the liquid has expanded and is ozzing out the tank car’s vents or overflows.

The key to minimizing the impact of the “Oops” is to know where this release will travel and how fast. All surface water drainage ditches near a transloading facility, a fueling station or other loading racks should be concrete and quick response cut-offs should be in place during loading or unloading.

Though surface water drainage migration is easy to figure out, spills rarely stay on the surface. When surface drainage passes over areas where road cuts or other construction have removed surface clays or other impervious materials, these releases may quickly sink into the immediate sub-surface stratum. One often overlooked situation is where sewer, water, or process lines cross this normal drainage path. It is a standard practice to backfill around buried pipes with loose gravel. Most do not realize that this is a drainage “canal” around the outside of the pipe. (note on drawing)

Though it is a standard practice, hosing down a spill on a concrete slab doesn’t make much “dollars or sense”. A simple 3 gallon fuel spill if captured by a bucket or better yet with a designed, roll-under spill pan (i.e. a Spill-Barrow™, see photo below), is easy to handle but if the plant management decides to just have some worker come out later and “hose it down” with about 50 gallons of water, now you’ve developed even more “hazardous material” which will need proper disposal. There’s a standard saying among environmental managers that needs to be posted in these areas. **Dilution is not the Solution to Pollution !** Capture a release as close to the source as possible.

When it comes to migration of spills or contaminated groundwater, **“Time is not in your favor”.** Contaminated liquids in unlined containment ponds or even storm drains will quickly sink into the sub-strata under your facility and will flow where it can. Under surface drainage paths are hard to predict since the local geology may be disrupted by man-made cuts or structures or local irregular geology like slip faults, sub-surface caves (i.e. in Florida or other locations with thick limestone layers), and local river cuts. The best motto is **"Catch it before it hits the ground !"**

Purchasing proper spill containment pans for under truck-to-rail transloading may seem expensive but doing nothing is even more expensive. While "cheap" open track pans are available, the rainwater that is collected in these shallow containments now adds to the facilities operational disposal costs. How much per gallon is your company paying for outside disposal or for all the equipment and labor to in-house purify your collected rainwater? A single, 20 ft. open track pan under a tankcar will usually collect about 8,976 gallon of water for in a region of 20 inches of annual rainfall. By regulation, this captured water has to be tested before pumping it over the side or "pulling the plug". This testing may cost around a $1,000 per sample.

In these northern climate areas, not only rainwater disposal impacts your plant's budget but now you add more labor costs. Cheap, open track containment pans will require manual "chipping out" of the ice and snow after each storm to keep them useable. Often overlooked is what happens to this shoveled out "tainted' snow and ice when the spring thaw comes along? To use a trite auto mechanic's quip, "Pay me now or pay me later !" when it comes to minor mechanical problems. The same is true for groundwater contamination. Avoiding collecting snow or rainwater by using closeable track pans does make "Dollars and Sense".

Sidebar Highlight

Back in the mid-80's, as manager of facility planning for Safety-Kleen Corp., I was leading a management team evaluating a possible site for a regional truck-to-rail transloading operation, just north of New York City. On the surface, the site had a good condition railroad spur track, plenty of flat land to build tanker truck parking and good access to major feeder highways around the city. As was our practice, our member environmental staff shortly after hired a well drilling firm to place sample wells and then do a detailed analysis of what they found.

The analysis showed excess quantities of tannic acid. This triggered both our environmental staff and the state's staff to attempt to find the source of this contamination. Further research uncovered that a leather tannery had been closed about twenty years earlier and it was over five miles up gradient from these current sample wells. Spills from processing vats and/or tainted surface water from tanker unloading operations had slowly migrated from surface water down into the immediate subsurface aquifer and continued it slow flow for years.

In yet another incident close-in to Kansas City, Kansas, we were evaluating a possible used motor oil truck-to-rail transloading site owned by the (then) Santa Fe Railroad. Upon sinking sampling wells and detailed sampling of the water, we recorded high concentrations of insecticides and pesticides. This was much simpler to identify the source. A large agricultural chemical company had their regional warehouse about a half mile up gradient from this potential transloading site. They apparently had spills or just washed inside spills out the door or loading dock ramps. We continued our search elsewhere.