

IPPTS Associates

Five Golden Rules for Successful Leachate Management

Practical tips that every landfill designer and operator should know and bear in mind.

DISCLAIMER: This information is provided "as is". The author, publishers and marketers of this information disclaim any loss or liability, either directly or indirectly as a consequence of applying the information presented herein, or in regard to the use and application of said information. No guarantee is given, either expressed or implied, in regard to the merchantability, accuracy, or acceptability of the information.

Contents

Introduction.....	3
Golden Rule # 1 – The Bad Weather Rule	5
Golden Rule # 2 – The “Use Absorptive Capacity” Rule	7
Golden Rule # 3 – Use the Landfill Itself to Treat Its Own Leachate	8
Golden Rule # 4 – It is Best to Treat Leachate On Site	9
Golden Rule # 5 – Use a Leachate Specialist!.....	12
Conclusion	14

Introduction

I think of these Golden Rules as nuggets of wisdom that will help anyone successfully, design, plan, and run landfills.



I have included them in this report because I think that although I don't believe you will find them in any textbook, I think that they are very important.

You should bear them in mind and do not forget them. Like stars to steer by, they're permanent markers to guide all those involved in Leachate Management and keep us moving in the direction of sustainability, and profitability, while also protecting the environment around landfills.

Find your Golden Rule, follow its star-like unwavering truth and become guided by it. Whatever your goals or task, there will be a Golden Rule that applies that will help keep yourself on track.

So here are the Golden Rules, these are the Five Best Rules for managing leachate on a landfill site.

They are the rules that, in over 20 years of acting as a landfill designer and consultant in leachate management and treatment (and my involvement in

hundreds of these projects), have in my experience most often not been followed when leachate management started to become a problem.

I am giving them to you because it concerns me if I see landfill problems, but most of all it brings me satisfaction to help people, and see things done well.

Golden Rule # 1 – The Bad Weather Rule

Always plan for bad weather, and don't assume that for example, with a new landfill or landfill cell, that (even if a water balance calculation has predicted that no leachate will be produced within a set time period), it won't happen.

The reason for doing that this way is that when heavy rain occurs there is seldom time to react, and install additional leachate management measures, before a large body of contaminated leachate builds up.

Quite soon, a pond or lake of leachate can form, and the ill-prepared landfill operator may find that their site is in danger of causing pollution to surface water and/or groundwater. When this happens the landfill operator will usually be in contravention of the local environmental regulator's waste regulations, unless measures are already in place to store and handle this leachate.

It frequently occurs that, contrary to leachate generation flow-modelling results carried out during a desk study says otherwise, leachate does appear at the base of the waste cell during the first wet season.

This happens due to the fact that there will usually be "short circuiting" of rainfall which trickles down through the waste much faster than the bulk permeability would suggest will happen, and the expected absorptive capacity within the waste won't be utilized immediately, so the volume is higher than expected.

In any event, due to the use of "average" figures in modeling, individual storms will vary, and quite often must be expected to exceed the predictions of modelling.

Golden Rule # 2 – The “Use Absorptive Capacity” Rule

Once a new landfill or a new cell in an existing landfill is producing leachate, always look for ways to use the remaining absorptive capacity (i.e. material which is still capable of absorbing moisture) in the waste to absorb more water (that is - absorb as much as possible of the leachate) without saturating it.

This is very important because by doing this you will minimize the net leachate production, and reduce your leachate disposal costs by soaking it into waste. In addition, pockets of dry waste, although unavoidable in parts of the site in normal sanitary waste infilling practices, will not contribute fully to landfill gas production. Also dry waste will not settle and stabilize as well as when, as high a proportion as possible of the absorptive capacity, is used.

Take into account that recirculation of leachate from the base of the waste (such that it may be lifted back to the top of the cell and allowed to soak back into the filled waste), may be the best way to achieve this, but should only be done where it is permitted by the environmental regulatory body, and in a manner which complies with any restrictions they apply.

Golden Rule # 3 – Use the Landfill Itself to Treat Its Own Leachate

If the landfill operator can delay treating, or disposing to sewer, a fresh young leachate of the sort that is highly odourous, and often black in colour, and pump it back into a methanogenic part of a landfill (or even back into the same waste cell which itself turns anaerobic), there will in almost all cases be a benefit from the anaerobic digestion (fermentation) of many of the contaminants, which will occur.

The reason that this is important is because fresh (acetogenic) leachate has a very high Biochemical Oxygen Demand (BOD) and Chemical Oxygen Demand (COD). After residing in a methanogenic (methane gas producing) landfill, the oxygen demand needed to be provided for, to achieve further treatment, will have been reduced, and in some cases by an order of magnitude.

Satisfying the oxygen demand during leachate treatment is expensive, whether treated on site or at a sewage works, so the cost of leachate treatment will be reduced very substantially (in almost all cases) by providing it with a residence period in a methanogenic landfill.

Golden Rule # 4 – It is Best to Treat Leachate On Site

Environmental regulators in many countries quite often suggest that leachate should simply be pumped to a sewer for treatment at a public sewage works (wastewater treatment plant). However, this may be driven more by their concerns that leachate treatment on site is difficult and hard to achieve reliably, than by a detailed appraisal of the best option.

The regulators will naturally be concerned not to recommend on site leachate treatment if they think it may result in a failed leachate plant discharging polluting flow.

However, it is not generally a good policy to treat strong leachate from modern sanitary landfills after discharging it into sewer, mixing it with sewage. Leachate has an extremely high ammoniacal nitrogen (“ammonia”) concentration when compared with the much weaker contamination levels in domestic and commercial/industrial foul sewage at sewage works.

Treating strong leachate at a sewage works, as if it were sewage, is inefficient and unnecessarily costly. In fact, unless the sewage works has a highly nitrifying type process, one of the most potentially damaging types of contaminants in leachate may simply be diluted by the weaker strengths of

those contaminants in the sewage, and not treated (chemically converted to environmental safe chemicals).

Ways of treating leachate on site reliably, without dilution, are available.

Proven processes exist for biological treatment of the leachate in specially designed plants tailored specifically to the special needs for producing a very high quality leachate effluent, which will then be capable of discharge either to a sewer with greatly reduced volumetric charges, or directly to a watercourse (river or stream).

Such treatment solutions normally include nitrification, and may also include denitrification, and membrane technology, depending on local regulatory requirements, and environmental needs.

These on site leachate treatment solutions are, when done in the correct way, not only more environmentally sustainable than off-site treatment, but usually incur lower medium to long-term cost, and most importantly are not nearly as subject to future unknowns, such as:

- rising volumetric charges levied by Municipal and Commercial Water Companies, and

- possible future withdrawal of sewage discharge consents when environmental regulation of the Municipal and Commercial Water Companies becomes more stringent.

The final reason for this, the “it’s best to treat leachate on site” rule, is that all leachate which is removed from a landfill which is producing landfill gas (which is 40% to 60% methane), will contain some of this explosive, high risk gas, in solution.

That means that, at least in theory, leachate is a danger to the sewer when the methane it contains is released into the airspace of the sewer, and this release will occur when it flows in the sewer.

So, another reason for treating leachate on site and for Rule #4, is that leachate will normally need the landfill gas removed before an off site sewer discharge can be made. This comes at yet more cost, and no benefit to the landfill operator, other than compliance with sewer safety (flammable discharge) regulations. (See www.methane-stripping.com for more information on Methane Stripping.)

Golden Rule # 5 – Use a Leachate Specialist!

The full description of this rule is: “Biological Treatment of Leachate in a Plant Designed by a Leachate Treatment Specialist Provides the Best Outcome for Cost, Environmental Protection, and Sustainability”.

(Ah! I know! You are probably saying to yourself at this point that this statement isn't a surprise to you, coming as it does, from a leachate expert!)

Let me explain:

Despite what is common perception, highly cost effective, proven and reliable biological leachate treatment on site (combined where appropriate with membrane treatment) is not difficult to achieve under the supervision of a leachate specialist, and has been achieved on many hundreds of landfill sites.

As long as specialists in leachate treatment design are engaged to carry out the design work, and carry that through to process commissioning and treatment plant site operator training outcomes are good, with these plants remaining in use with little or no alteration after 20 and 30 years of use.

This may include, where appropriate, biological treatability trials at the start of the design, to ensure the right process, and an optimised set of design parameters is set for the detailed process plant design.

It is very important to comply with this rule and only engage leachate treatment specialists with a proven track record of achievement. This is because, doing so is the difference between the sort of leachate treatment plant which sits in the background simply doing its job, and does not get publicised, and the type which are designed by non-leachate specialists, for which exactly the opposite has all too often been true.

It is still the case that leachate treatment plant designs by general water treatment designers are often based on sewage treatment methods long discredited for use with leachate, or at best use less than the most appropriate technologies, their use being promoted by salesmen for a particular in-house treatment process product.

It is not surprising therefore that such prototypes fail when applied to leachate treatment by water process designers more used to designing for much less contaminated effluents than leachate.

Conclusion

Follow these golden rules for managing leachate on landfill sites, and avoid the problems experienced by many others, and you'll generally find life easier, your progress more rapid, and your successes more frequent.

You can learn more about methods to manage leachate, on your landfill, and landfills in general, by visiting the leachate website at www.leachate.co.uk