People who are enthusiastic about garbage incinerators often fail
to mention that every incinerator has a landfill associated with it.
The ash left over from incineration needs to be landfilled, and the
ash is toxic. Some engineers (especially those employed to
promote garbage incinerators) try to argue that the toxic
constituents of the ash will remain safely in the landfill
“forever.” But this is a flawed view: the weight of evidence and
opinion in the technical world does not agree with this argument.
On the contrary, even the U.S. Environmental Protection Agency
says that all landfills will leak. The agency has published this
opinion in many occasions in the FEDERAL REGISTER. But
before we look at the EPA’s reasons for believing all landfills
will leak, let’s look at the way landfills are constructed:

A landfill is a carefully-engineered depression in the ground (or
built on top of the ground, resembling a football stadium) into
which wastes are put. The intention is to avoid any hydraulic
[water-related] connection between the wastes and the natural
environment. To achieve this goal, there are four important parts
of all landfills: a bottom liner, a leachate collection system, a
cover, and the natural hydrogeologic setting (the earth).

The hydrogeologic setting can be selected to slow the entry of
wastes into the natural environment. The other three components
must be engineered. The bottom liner can be one or more layers
of clay or a synthetic flexible membrane liner [FML], for
example, a sheet of plastic; the liner effectively creates a bathtub
in the ground. The leachate collection system consists of sloping
the sides of the landfill and putting pipes in the lowest places, to
pump out contaminated water and other fluids (leachate) as they
accumulate; the pumped leachate is treated at a wastewater
treatment plant (and the solids removed from the leachate during
this step are returned to the landfill, or are sent to some other
landfill). The cover or cap will consist of several sloped layers of
clay or FML (to prevent rain from intruding), overlain by a very
permeable layer of sandy or gravelly soil, overlain by topsoil in
which vegetation can root (to stabilize the underlying layers of
the cap).

Each of these components is critical to success. If the bottom
liner fails, wastes will migrate directly into the environment. If
leachate collection pipes clog up and leachate remains in the
landfill, fluids can build up in the bathtub; the resulting liquid
pressure becomes the main force driving waste out the bottom of
the landfill when the bottom liner fails. If the cover (cap) is not
maintained, rain will enter the landfill, resulting in buildup of
leachate to the point where the bathtub overflows its sides and
wastes enter the environment.

In the FEDERAL REGISTER Feb. 5, 1981, the EPA first stated
its opinion that all landfills will eventually leak:

“There is good theoretical and empirical evidence that the
hazardous constituents that are placed in land disposal facilities
very likely will migrate from the facility into the broader
environment. This may occur several years, even many decades,
after placement of the waste in the facility, but data and scientific
prediction indicate that, in most cases, even with the application
of best available land disposal technology, it will occur
eventually.” [pg. 11128]

“Manmade permeable materials that might be used for liners or
and covers (e.g., membrane liners or other materials) are subject to
eventual deterioration, and although this might not occur for 10,
20 or more years, it eventually occurs and, when it does, leachate
will migrate out of the facility.” [pg. 11128]

“Unfortunately, at the present time, it is not technologically and
institutionally possible to contain wastes and constituents forever
or for the long time periods that may be necessary to allow
adequate degradation to be achieved.” [pg. 11129]

“Consequently, the regulation of hazardous waste land disposal
facilities must proceed from the assumption that migration of
hazardous wastes and their constituents and by-products from a
land disposal facility will inevitably occur.” [pg. 11129]

More than a year later, on July 26, 1982, the EPA again put its
opinions into the FEDERAL REGISTER, emphasizing that all
landfills will inevitably leak:

“A liner is a barrier technology that prevents or greatly restricts
migration of liquids into the ground. No liner, however, can keep
all liquids out of the ground for all time. Eventually liners will
either degrade, tear, or crack and will allow liquids to migrate out
of the unit.” [pg. 32284]

“Some have argued that liners are devices that provide a
perpetual seal against any migration from a waste management
unit. EPA has concluded that the more reasonable assumption,
based on what is known about the pressures placed on liners over
time, is that any liner will begin to leak eventually.” [pgs.
32284-32285].

In the FEDERAL REGISTER May 26, 1981, pgs. 28314 through
28328), the EPA argued forcefully that all landfills will
eventually leak. Another EPA quote:

“Many organic constituents are stable (degrade very slowly);
other hazardous constituents (e.g., toxic metals) never degrade.
Yet the existing technology for disposing of hazardous wastes on
or in the land cannot confidently isolate these wastes from the
environment forever.

“Since disposing of hazardous wastes in or on the land inevitable
[inevitably?] results in the release of hazardous constituents to
the environment at some time, any land disposal facility creates
some risk.” [pg. 28315]

EPA went on to estimate that the duration of the hazard from a
landfill would be “many thousands of years.” [pg. 28315] And
the Agency said, “The longer one wishes to contain waste, the
more difficult the task becomes. Synthetic liners and caps will
degrade; soil liners and caps may erode and crack. ...EPA is not
aware of any field data showing successful long-term
containment of waste at facilities which have not been
maintained over time.” [pg. 28324]
“Ultimately, waste reduction and resource recovery probably provide the best alternative to land disposal,” said the EPA [pg. 28325], though it has never begun any programs to make this happen.

--Peter Montague

Descriptor terms: ash; epa; landfilling; soil; leachate; hazardous waste; land; land disposal; heavy metals; water pollution

Rachel’s Environment & Health News is a publication of the Environmental Research Foundation, P.O. Box 160, New Brunswick, NJ 08903-0160; Phone: (732) 828-9995; Fax (732) 791-4603; E-mail: erf@rachel.org; http://www.rachel.org. Unless otherwise indicated, Rachel’s is written by Peter Montague.