Journal of Hazardous Materials, 1 (1975/76) 157—164

Case History

DAMAGE INCIDENTS FROM IMPROPER LAND DISPOSAL*

EMERY C. LAZAR
Hazardous Waste Management Division, Office of Solid Waste Management Programs, U.S. Environmental Protection Agency, Washington, D.C. 20460 (U.S.A.)
(Received May 12, 1975)

Summary

The hazardous waste disposal problem has assumed particularly significant proportions lately because of the progressive implementation of air and water pollution control programs, ocean dumping bans, and cancellation of pesticide registrations. The net result has been an increased tonnage of land-disposed wastes, with adverse impact on public health and the environment. The problem is manifested in groundwater contamination via leachate, surface water contamination via runoff, air pollution via open burning, evaporation, sublimation and wind erosion, poisonings via direct contact and through the food chain, and fires and explosions at land disposal sites. The subject presentation cites case studies that are associated with these various mechanisms of damage.

There is a growing trend to dispose of hazardous industrial wastes on the land, as the nation is moving toward implementation of more stringent requirements governing the discharge of toxic pollutants into the media of air and water. Our studies to date have indicated that the prevailing methods of land disposal of hazardous wastes are largely inadequate, due to a general lack of economic and legislative incentives [1]. This paper will give an overview of the types of damages that can result from improper land disposal of hazardous wastes.

Before entering into a discussion of damages, I would like to emphasize that the term "damage" does not need to be associated with a reported human or environmental injury of some sort. The Office of Solid Waste Management Programs has on file case studies that document various degrees of injury to humans — some even with fatal outcome — as well as a broad spectrum of environmental damage. It must be remembered, however, that most cases of toxic exposure to hazardous pollutants manifest themselves in insidious chronic effects that are almost impossible to trace back to the causative agents. Only in rare instances of chronic poisoning is a positive correlation of cause and effect possible.

In order to understand the full extent of the problem, we at the EPA have

*Paper presented at the National Conference on Management and Disposal of Residues from the Treatment of Industrial Wastewaters, Washington, D.C., February 5, 1975.

had to revise our concept of the damages resulting from hazardous waste disposal to include damages which are not reported, not recorded, and not even known. For example, if someone is drinking brackish well water and not complaining because he feels he has no alternative, he is damaged. And if someone drills a well and cannot use the water he finds and so has to drill another well, he is damaged. And if a company decides not to open a plant in a town because the groundwater is polluted, there is damage. In fact, if leachate moves from a disposal site to another person's property, even if no one uses the water or is aware of the movement, there is damage because the property owner has been deprived of the potential use of his groundwater.

We have investigated damage incidents which can be attributed to the improper land disposal of those industrial wastes that fall under the "hazardous" category, as defined in several bills that have been introduced to the Congress during the past two years. In each case study the wastes have constituents that ". . . pose a substantial present or potential hazard to human health or living organisms because such wastes are nondegradable or persistent in nature or because they can be biologically magnified, or because they can be lethal, or because they may otherwise cause or tend to cause detrimental cumulative effects."* Generally, the available case studies pertain to hazardous chemicals belonging to the following categories: (a) toxic metals (*e.g.* arsenic, chromium, lead, mercury, cadmium); (b) toxic anions (*e.g.* cyanide and fluoride); and (c) a variety of toxic organic chemicals (*e.g.* miscellaneous pesticides, polychlorinated biphenyls, other chlorinated hydrocarbons, industrial solvents).

There are six major routes of environmental transport through which the improper land disposal of hazardous wastes can result in damage:

(1) groundwater contamination via leachate;
(2) surface water contamination via runoff;
(3) air pollution via open burning, evaporation, sublimation, and wind erosion
(4) poisoning via direct contact;
(5) poisoning via the food chain;
(6) fire and explosion.

In the following, each of these forms of damage will be discussed in turn. It is not the purpose of this paper to point an accusing finger on any particular firm or industry category. Our objective is to demonstrate that the problem of hazardous industrial waste disposal is real. A public recognition of the problem is paramount to its solution.

1. Groundwater contamination via leachate

It is interesting to note that the problem of groundwater contamination received almost no attention until very recently, although approximately 50% of the nation's domestic water supplies are derived from underground aquifers. Throughout the eighty-nine pages of the Federal Water Pollution Control Act

*This definition appeared in the Proposed Hazardous Waste Management Act of 1973.

Amendments of 1972, the term "groundwater" appears only twice! It is encouraging to note that there is a steadily growing concern now for groundwater quality, as evidenced by the recently enacted Safe Drinking Water Act.

The quality of our groundwaters is closely related to land disposal practices. A recent study sponsored by the EPA investigated the groundwater situation in eleven northeastern States. The study concluded that the thousands of acres of landfills containing municipal and industrial solid wastes are an almost universal source of groundwater contamination in the region investigated. Another major conclusion was that industrial storage and disposal lagoons, pits, and basins are leaking many millions of gallons per year of potentially hazardous substances to the groundwater [2].

The major perils inherent in groundwater contamination are the elusive nature and the long duration of the problem. Almost all of the case studies reported to date were discovered after the damage to the groundwater had already occurred. Also, the subsurface migration of pollutants is a very slow process, which means that most of the damages caused by the disposal of huge quantities of hazardous wastes during the past decades are still to be evidenced. And once the problem manifests itself, it may take decades or centuries and enormous resources — if the technology is available — to remedy the damages. The following case studies will serve to illustrate these points.

- As a result of burying arsenic-containing pesticides in Minnesota in the mid-1930's, eleven persons developed symptoms of arsenic poisoning in 1972, after drinking contaminated well water. Two of the victims required hospitalization and treatment.

- A New York electroplating firm has been discharging its waste waters into unlined settling ponds since the early 1940's. Although the effluents have received chemical treatment since 1958, the surrounding groundwater was recently found to be still contaminated with toxic cadmium and hexavalent chromium.

- From 1953 to 1973, a laboratory company in Iowa utilized a dump site for solid waste disposal. Over 250,000 cubic feet of arsenic-bearing wastes have been deposited there. Monitoring wells around the dump have established over 175 ppm arsenic in the groundwater. (The U.S. Public Health Service drinking water standard for arsenic is 0.05 ppm.) The dump site is located above a limestone bedrock aquifer, from which 70% of the nearby city's residents obtain their drinking and crop irrigation water. Although there is no evidence that the drinking water is being affected, the potential for contamination cannot be underestimated.

- In 1971, a major chemical company contracted with a trucker to haul approximately 6,000 drums of petrochemical wastes to a landfill for disposal. Instead, most of these wastes were transported to an abandoned chicken

farm in New Jersey, where they were stockpiled and subsequently dumped. Within two years, a major aquifer had become contaminated with petrochemicals, resulting in the condemning of approximately 150 private wells. The cost of extending public water supply into the area was about $300,000. Moreover, this incident resulted in adverse impact on local building and development. The exact magnitude of the environmental and economic damage has not yet been delineated.

- For about nine years, a large municipal landfill in Delaware accepted both domestic and industrial wastes. In 1968, this disposal site was closed and forgotten about. Four years later, chemical and biological leachates were detected in the groundwater. According to recent estimates, up to $26 million will be required to stop further deterioration of an underground aquifer which not only serves as a drinking water supply to over 40,000 area residents but is also needed for industrial use. To date, approximately $2 million has been spent on this groundwater pollution incident, excluding administrative and legal expenses.

2. Surface water contamination via runoff

Even relatively insoluble industrial solid wastes that are dumped on land ultimately find their way into surface waters through natural runoff. Similarly, numerous case studies have shown that improperly lagooned liquid wastes travel to surface streams by overflow or seepage through dikes. Quite often, the dumping of hazardous wastes on land results in both ground- and surface-water contamination, as the following damage incident illustrates.

- From 1969 to 1972, an estimated 15,000 drums of industrial wastes containing cyanides, arsenic, cadmium, chromium, petroleum products, acids, and miscellaneous other toxic and corrosive materials were dumped on farm land in Illinois. The problem first received attention in May 1974, when three dead cattle were discovered in the area. Pathological examination revealed that the cattle had died of cyanide poisoning. Chemical analysis of nearby surface water runoff indicated a maximum cyanide concentration of 365 ppm. (The U.S. Public Health Service drinking water standard for cyanide is 0.2 ppm.) After the dumping had ceased but before the damages were evident, a portion of the affected farm land was purchased by a company which was subsequently faced with the clean-up problems. A consulting firm, hired by the new owners, has prepared a comprehensive study of this incident, which documents the substantial damage to local wildlife, vegetation, and groundwaters.

3. Air pollution via open burning, evaporation, sublimation, and wind erosion

Frequently, the harmful effects of wastes dumped on land are transmitted

to the environment through the medium of air. There are relatively few *reported* damage incidents falling under this category, because most monitoring and enforcement actions thus far have been water-pollution-related. Burning dumps have not only emitted irritating and toxic fumes but have also caused automobile accidents by creating poor visibility. One chain accident of such origin on the New Jersey Turnpike made national headlines a few years ago. Also, the evaporation and sublimation of volatile toxic industrial liquid and solid wastes, respectively, is a public health and environmental hazard that should not be underestimated.

- One case in point relates to the land disposal of hexachlorobenzene (HCB) in Louisiana in 1973. The HCB, which is a toxic solid byproduct in the manufacture of perchloroethylene, was dumped in a rural landfill, where it sublimed into the air. Other sources of HCB air emission were manufacturing plants in the area and spilled wastes from trucks hauling the material to the dump. The HCB was ultimately absorbed into the body tissues of cattle. As a result, up to 20,000 head of cattle were quarantined by the Louisiana Department of Agriculture. The economic loss to affected ranchers was estimated at $3.9 million. Sampling and testing alone has cost the State and Federal governments over $150,000.

- Another well publicized incident in this category pertains to an industrial solvent reprocessing firm in Maryland that dumped large quantities of volatile organic liquid wastes into a sand and gravel quarry. Wide-scale complaints by area residents about nauseating fumes resulted in State action that banned the dumping in August 1974; however, the public health implications of this incident are far from being resolved.

Wind erosion of harmful dusts from land-disposed solid wastes is not only an occupational hazard for landfill operators but can affect the health of area residents as well, as pointed out in the following example.

- One potentially debilitating damage to health is the inhalation of asbestos dust, which can cause asbestosis, lung cancer, mesotheliomas, and pleural lesions in humans. Nevertheless, industrial asbestos wastes are often disposed on land without providing a soil cover to prevent wind erosion of the harmful fibers. In spite of ample local publicity about the potential hazards, children are still using a playground in Pennsylvania that is located directly adjacent to an inactive 1.5 million cubic yard pile of industrial asbestos wastes.

4. **Poisoning via direct contact**

This type of injury is very common to extremely toxic wastes, such as cer-

tain surplus pesticides and pesticide containers*. The case studies in our files are generally illustrative of lack of safe disposal rather than improper land disposal.

- In 1972, a $2\frac{1}{2}$-year-old child in Arkansas became ill after playing among a pile of 55-gal drums. He was admitted to the hospital, suffering from symptoms of organophosphate poisoning. The drums were located approximately 50 ft. from the parents' front door on city property. The city had procured the drums from an aerial applicator, to be used as trash containers. The residents were urged to pick up a drum in order to expedite trash collection. It has been determined that these drums contained various pesticides, including methyl parathion, ethyl parathion, toxaphene, DDT, and others. The containers were in various states of deterioration, and enough concentrate was in evidence to intoxicate a child or anyone else who came into contact with it.

- In 1969, Di-Syston was added to the soil in a potato field in Idaho. The "empty" paper bags from the pesticide were left in the field, and the wind blew them into the adjacent pasture. Fourteen head of cattle died, some with convulsions, after licking the bags.

- At least eighteen persons were hospitalized and two firemen suffered permanently disabling lung damage in California in 1973 after inhaling a nematocide emanating from an undepleted 300-lb. pressurized canister that had been improperly disposed of by the manufacturer. A businessman had obtained the canister in order to "make a nice standup fireplace."

5. Poisoning via the food chain

Land-disposal-related incidents which result in this form of damage are particularly difficult to identify and to confirm, because of the existing gaps in the required scientific evidence. For example, our data base at this juncture is inadequate to determine the number of years before various food crops can be safely harvested on farm land where certain hazardous wastes had been deposited. The following case study, which has received considerable publicity in recent years, illustrates how land-disposed wastes can exert health damage by entering the food chain.

- In 1969, three children in a New Mexico family sustained serious alkyl mercury poisoning after eating contaminated pork. A fourth child in this family suffered congenital mercury poisoning after his mother had consumed

*On May 1, 1974, EPA issued disposal and storage guidelines designed to prevent such injuries. These guidelines were promulgated under authority of the Federal Insecticide, Fungicide, and Rodenticide Act as Amended in 1972. (Federal Register 39:85, pp. 15236—15241, 40 CFR 165.)

the same pork in her first trimester of pregnancy. The hog had been fed grain treated with a methyl-mercury-type seed dressing. The grain originated from a seed company, where the father of the children obtained the floor sweepings without charge and subsequently fed these to the hogs he was raising. This incident is not specifically related to land disposal; however, about 100 bags of similarly treated grain were discovered subsequently at the community dump of another town in New Mexico. It was established by public health authorities that some of this dumped grain — which originated from a different source than in the previous case — had been scavenged and used as animal feed in the area. As a result, a large number of hogs, chickens, and other animals had to be quarantined.

6. Fire and explosion

We know of numerous injuries to landfill operating personnel, caused by fires and explosions. Such accidents are avoidable if proper safety precautions are followed. One form of hazardous waste mismanagement is the mixing of chemically reactive, mutually incompatible materials. A similar violation of common safety principles is the landfilling of unidentified chemical wastes, as the following case study will illustrate.

- In October 1974, a bulldozer operator was killed in an explosion at an industrial landfill in New Jersey, as he was burying and compacting several 55-gal drums of unidentified chemical wastes. The victim died as a result of burns, which covered about 85% of his body.

To put the damage cases involving improper land disposal of hazardous wastes into a true perspective, one must realize that the existence of only a very small fraction of such incidents has been uncovered. In most cases of improper land disposal, nobody is aware of these incidents except the disposers, and quite often even they do not realize the full environmental implications of their actions. In many instances where local citizens know about or suspect environmental damages, they do not report them. Finally, there are those cases of potential damage that have been reported but have never been verified by competent authorities.

Another point that requires emphasis is that except for some transportation-related hazardous waste spills, the types of incidents we have considered do not fall under the category of accidents. Practically all of these damages could have been avoided by prudent and responsible hazardous waste management. In the course of our investigations, we have found that a wide array of treatment and disposal options is available for most hazardous wastes. In those particular situations where this is not the case, safe and controlled storage of the wastes is possible until adequate treatment and disposal technology can be developed. It is true that environmentally sound hazardous waste management is costly, but in the long run it is less expensive than seemingly cheap, improper

land disposal, when measured in terms of the damages to public health, to the environment and to property, and the usually exorbitant magnitude of clean-up costs, all of which are associated with the latter alternative.

Let me conclude on an optimistic note. We at the Office of Solid Waste Management Programs are hopeful that cooperation between government and industry, as exemplified by this Conference, will hasten the day when we shall have to search for damage case studies in the dusty, forgotten depths of our archives.

References

1 U.S. Environmental Protection Agency, Office of Solid Waste Management Programs. Disposal of hazardous wastes; report to Congress, Environmental Protection Publication SW-115, U.S. Government Printing Office, Washington, D.C., 1974 (110 pp.).
2 D.W. Miller, F.A. DeLuca and T.L. Tessier, Ground water contamination in the Northeast States. U.S. Government Printing Office, Washington, D.C., 1974 (325 pp.).