

Groundwater related environmental problems after an earthquake

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Abstract

Earthquakes are a significant threat to public safety and welfare over many parts of the world. Earthquakes affect hazardous wastes management facilities because they can damage structures that hold wastes and result in accidental releases to groundwater. Damage can result from movement of large pieces of ground or, more commonly, groundshaking. Because structures that hold hazardous waste (landfills, ponds, or lagoons) are often made of soil and rock, they can be damaged by earthquake activity. Structures above the ground, such as tanks and incinerators can also be damaged, toppled, or destroyed.

Locating hazardous waste management facilities in certain areas – because of their soil, terrain, groundwater, or weather condition – may pose significant risks of releases and possible exposures to human and the environment.

Extended Summary

In this paper will be considered contamination in **shallow** and **deep groundwater** due to earthquake activity.

Situation after an earthquake will bring serious harmful effects on groundwater. New moved state of the layers will be unknown picture about quantitative and qualitative character of the groundwater reservoirs. The following faults are potential disaster for the shallow and deep groundwater. Now the shallow groundwater in many cases is severely contaminated by human, industrial and agricultural wastes. But deep groundwater is the future source for water supply.

The importance of groundwater is vital too much of live on Earth, because the groundwater represents around 30% of freshwater resources of the earth, while lakes and rivers correspond to less than 1% and the largest volume of freshwater is stored in glaciers (69%).

A significant part of the World's countries suffer from shortage of good quality drinking water supply. The need for more careful management of our planet's water resources is growing because of the growing demand of the growing population.

The future development of many countries will depend decisively upon how the increasing demand for water will satisfied and how the economic and environmental cost for that demand may be met.

Hence, protection of soil- and groundwater resources against depletion and degradation has developed into one of today's foremost problem worldwide.

Future generation must be guaranteed sufficient water supplies free of health risks through regulated use and protection against contamination of groundwater resources.

Groundwater contamination can originate on the surface of the ground, in the ground above the water table or in the ground bellow the water table. Given table shows the types of activities that can cause groundwater contamination at each level.

GROUND	Infiltration of polluted surface water	De-icing salt use & storage
SURFACE	Land disposal of wastes	Animal feedlots
	Stockpiles	Fertilizers & pesticides
	Dumps	Accidental spills
	Sewage sludge disposal	Airborne source particulates

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ABOVE WATER TABLE	Septic tanks, cesspools, & privies Holding ponds & lagoons Sanitary landfills Waste disposal in excavations Underground storage tank leaks	Underground pipeline leaks Artificial recharge Sumps and dry wells Graveyards
BELOW WATER TABLE	Waste disposal in wells Drainage wells and canals Underground storage Mines	Exploratory wells Abandoned wells Water-supply wells Ground-water withdrawal

Most frequently reported sources of groundwater contamination due to earthquake activities are: underground storage tanks, septic tanks, municipal landfills and agricultural activities.

A major cause of **shallow groundwater contamination** is effluent, or outflow from septic tanks, cesspools and privies.

Big part of homes rely on septic systems to dispose of their human wastes.

In these systems are, improperly sited designed constructed or maintained, they can allow contamination of the ground water by bacteria, nitrates, viruses, synthetic detergents, household chemicals, and chlorides. Although, each system can make an insignificant contribution to groundwater, contamination the sheer number of such systems and their widespread use in every area that does not have a public sewage treatment system makes the serious contamination sources.

Case of Bulgaria (Fig.1), many homes situated on the Black Sea coast use septic tanks, which are improperly constructed.

Earthquakes caused remarkable landslides on that coastal areas (the depth of the sliding surface vary between 5-20m, the road is interrupted, some tens of houses, electrical and sewerage systems are destroyed), that followed contaminated shallow groundwater. This water was a source for water supply.

Deep groundwater is polluted by underground storage tanks. Between five and six million underground storage tanks are used to store a variety of materials, including gasoline, fuel oil, and numerous chemicals.

A particularly dangerous source for deep groundwater contamination is the disposal of nuclear waste (Fig.2), if adequate measures are not designed and implemented.

Facilities constructed on unstable ground are at greater risk for landslides, which could cause accidental hazardous waste releases.

Earthquake experts recommend a number of safety features for facilities in areas where earthquake activity can cause ground shaking or ground rupture:

- Design structures at hazardous waste management facilities to resist ground motion or shaking and withstand the maximum horizontal acceleration value expected at the earth surface in that particular area. It has been found that the horizontal direction of shaking is much more damaging to structures than the vertical direction.
- Build structure containment systems to prevent spills in case of a failure.
- Pay special attention to site factors such as soil moisture and slope stability which may enhance ground shaking and lead to structural failure

To prevent groundwater from contamination need careful management of waste disposal. Hazardous toxic dumps should be located in an area, which is geologically stable.

Above ground systems can be monitored easily and remedies put in place quickly. With a below ground site there is a real risk of “out of sight, out of mind” and the problem will not be noticed until severe damage has occurred to groundwater systems.

We have a responsibility to future generations to safeguard their environment as much as we can.

This is especially important because subsurface processes are extraordinary slow, and harmful or toxic effects may only become evident several years or decades after a contaminant release. Rehabilitation of contaminated soils or aquifers – if possible at all – frequently requires many years, or even generations.

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Fig.1, The North Bulgarian Black Sea Coast

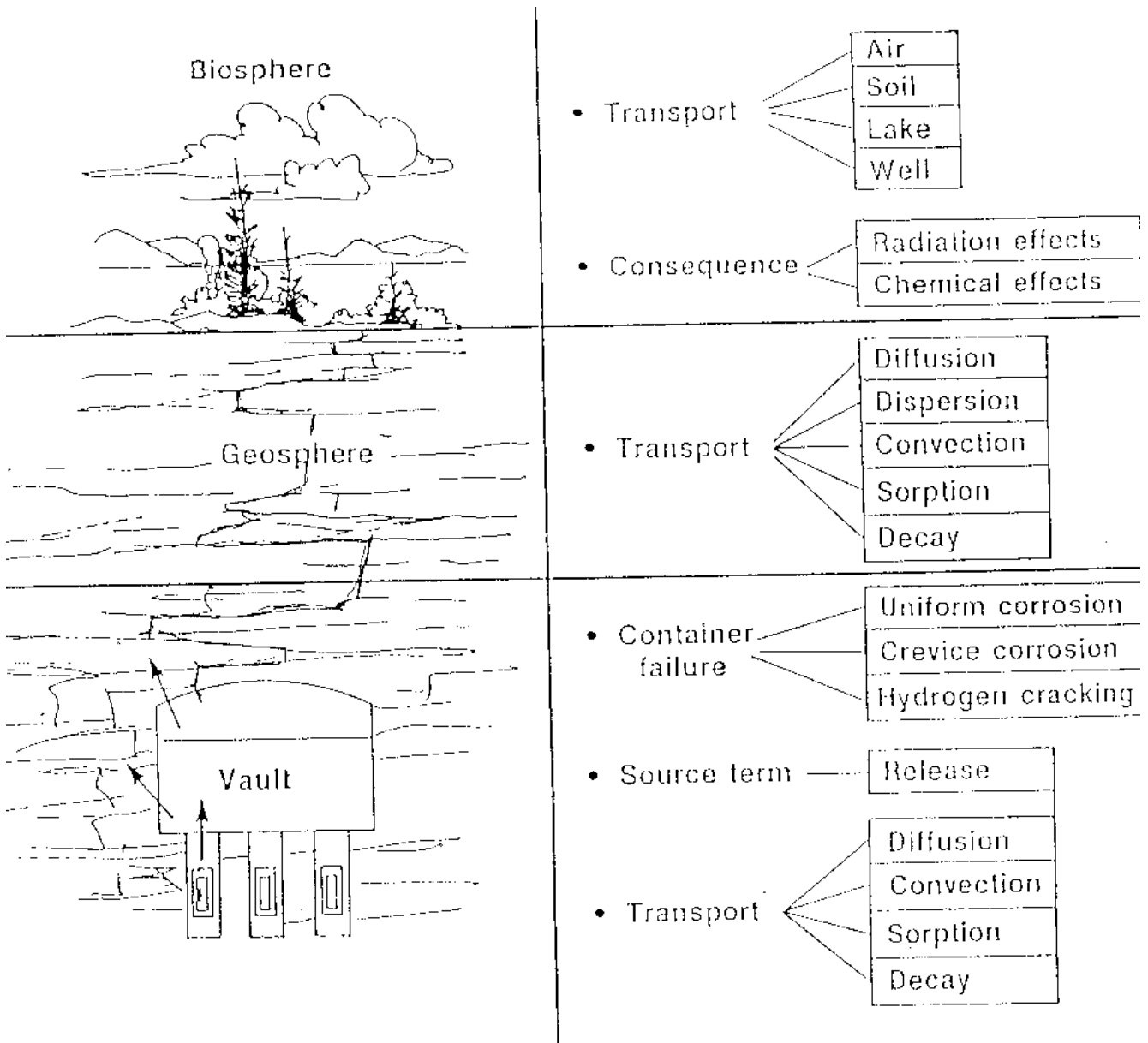


Fig.2, A Nuclear Waste Repository