RECHARGE TO LOW-LEVEL RADIOACTIVE-WASTE BURIAL TRENCHES 11 THROUGH 14, WEST VALLEY, NEW YORK

U.S. GEOLOGICAL SURVEY

Open-file Report 79-990

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CONVERSION FACTORS AND ABBREVIATIONS

The following factors may be used to convert U.S. customary units of measurement in this report to International System (SI) units.

U.S. customary units	Multiply by	To obtain SI units
	Length	
inch (in.)	2.540	centimeter (cm)
foot (ft)	0.3048	meter (m)
mile (mi)	1.609	kilometer (km)
	Area	
square inch (in^2)	6.452	square centimeter (cm^2)
square foot (ft^2)	929.03	square centimeter (cm^2)
acre	2.137	hectare (ha)
	Volume	
cubic foot (ft^3)	28.31	liter (L)
gallon (gal)	3.785	liter (L)
cubic foot (ft^3)	0.02827	cubic meter (m^3)

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ABSTRACT

After the dry summer of 1978, water levels began to rise in four of seven newer low-level radioactive-waste burial trenches at the Western New York Nuclear Service Center. The water-level rise in these trenches does not seem to be related to ground-water inflow, but rather to increased infiltration of precipitation through the clay-rich till cover over the trenches. The increase in infiltration is attributed to inflow through cracks caused by dessication and (or) settling of the buried refuse.

INTRODUCTION

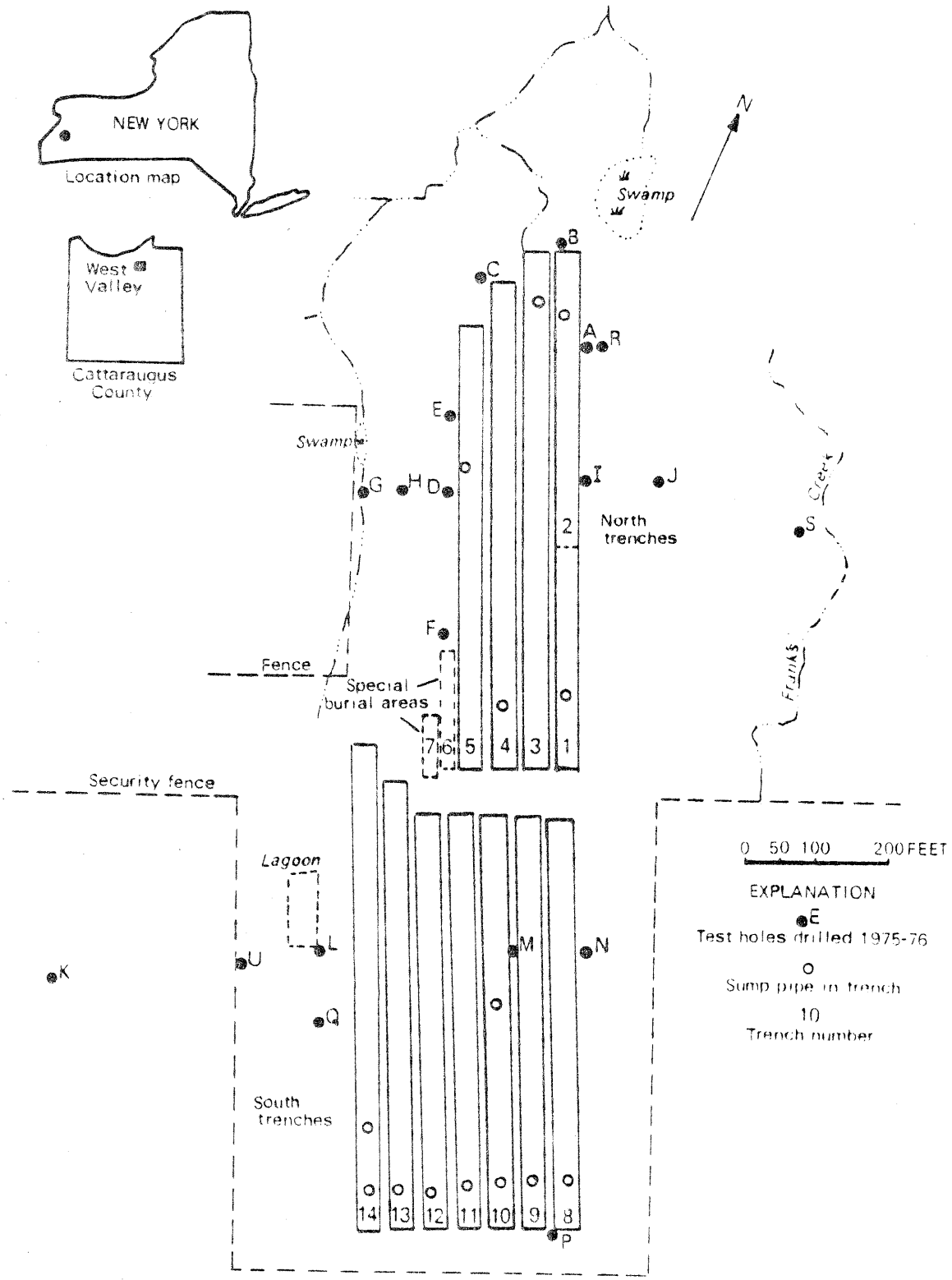
Among the facilities at the Western New York Nuclear Service Center near West Valley, New York, is a State-licensed burial ground for commercial low-level radioactive wastes. The area used to dispose of the waste covers 11 acres and contains a series of 12 trenches and 2 special burial areas (fig. 1). The trenches are excavated in a silty clay till that contains scattered lenses of silt, sand, and gravel, with generally very low permeability. A typical trench is 600 to 700 ft long, 35 ft wide at the top, and 20 ft deep. Trenches 1-5 were filled in sequence with waste from November 1963 to February 1969 and were covered with 4 to 6 ft of reworked till. Trenches 8-14 were filled sequentially from February 1969 to May 1975 and were covered with 8 ft of reworked till.

Since completion of the seven low-level radioactive-waste burial trenches (8-14) in the newer south end of the burial area, water levels in the trenches had remained stable (except in trench 14, where they rose about 2 ft from 1976-1977) until the fall of 1978, when water levels in trenches 11-13 began to rise at appreciable rates. The purpose of this report is to discuss the possible causes that produced the rise in water levels in these trenches.

RECHARGE TO TRENCHES 11-14

Prudic and Randall (1977) present a discussion of the ground-water flow system that indicates ground water to flow generally downward and outward from the south trenches (trenches 8-14). Information collected since the release of that report does not change this view. In particular, the water-level trend in trench 14, the trench most likely to be affected by ground-water fluctuations, has shown an erratic upward trend that corresponds more closely to rainfall than to changes in water levels measured in the till nearby. Therefore, it does not seem that ground-water seepage is a principal cause of the water-level rise.

Prudic and Randall (1977) demonstrate a good correlation between rainfall and water-level rises in trench 5 during the moderately dry summer of 1975 and also point out that rapid infiltration of surface runoff through open cracks in the cover can explain that correlation. It is likely that the apparent dessication cracks atop the trenches extended deeper than normal during the summer of 1978, which was the dryest summer since final grade was established on trenches 12-14 in 1975, and was almost certainly the dryest summer since 1971 (based on streamflow records for Cattaraugus Creek and on long-term precipitation records for Franklinville, which most closely resemble the 4-year precipitation record at the burial ground.) The air permeability of the trench 12 cover was measured in July 1978, after 7 weeks of dry weather, and was found to be 50 times higher than in August 1977. Water levels in trenches 3-5 were nearly stable until the end of the unusually dry summer of 1971, but thereafter rose continuously through the following winter and summer. The same seems to have happened in 1978 in trenches 11-14, in which water began to rise late that summer. Apparently, once cracks penetrate through the cover and are thus open-bottomed, they do not close completely even during wet periods.



NOTE: Map based on plane-table survey by R.J. Martin, U.S. Geological Survey, 1975-78.

Figure 1.--Locations of low-level radioactive-waste burial trenches, West Valley, N.Y.

It is uncertain how deep the drying cracks may extend into the cover. The undisturbed till at the burial ground and elsewhere contains oxidized fractures to depths of 15 feet, presumably produced by drying, but they may have reached this depth only during the most extreme droughts over the past 10,000 years. The theoretical limit to which fractures could remain open in undisturbed till, based on laboratory consolidation tests, is 50 ft (reported by Dana and others, 1978). However, it seems possible that drying fractures would not need to penetrate the entire cover thickness to allow infiltration because cracks from the base of the cover have been forming as a result of refuse decay and settlement over the years.

At least one large settlement feature was observed on trench 12 during April 1979, the first of its size on the south trenches. The upward extension of settlement fractures should be a progressive function of time, whereas the downward extension of drying fractures should be an intermittent function of summer precipitation. Perhaps the two types of fractures intersected in late summer 1978.

The water level in trench 14 has been increasing since the trench was completed in 1975, and air-pressure measurements during 1977 indicated the cover over trench 14 to be 10 times more permeable to air than any trench cover measured, including that of trench 5. Because trench 14 is the last trench in the south burial area, no temporary pile of material excavated from the next trench, such as the previous trenches had received, was added to the cover over trench 14, which could explain this higher permeability. However, the water level in trench 14 began to rise more than twice as fast after the summer of 1978 than before, which suggests that the cover over trench 14 had become even more permeable.

Another hypothesis is that the pumpout of trench water from the south trenches may have caused compaction of the waste, which, in turn, caused subsidence cracks in the cover. Trenches 11 and 14 were pumped for the first time in late 1977 (about 26,000 gallons was removed from trench 11 and 126,000 gallons from trench 14), and both showed striking water-level rises in 1978. (Trench 10 was also pumped, but only about 9,000 gallons was removed.) However, the following observations suggest that the pumpdowns did not cause the subsequent rapid rise in trenches 11-14.

1. Water level in trench 12 did not rise in 1977 (the wettest year since at least 1968) after the removal of about 22,000 gallons in September 1976, but began to rise in the fall of 1978.

2. Trench 13 has never been pumped, yet the water level rose in the fall of 1978.

3. Trenches 3-5 were not pumped before 1971, the year water levels began to rise at accelerated rates.

4. The north trenches experienced far larger pumpdowns in 1975-1977, during which time the entire thickness of refuse had been saturated, but they did not exhibit a subsequent increase in the rate of water-level rise comparable to that noted in trenches 11, 12, and 14 in 1978 after the pumpdowns.

CONCLUSIONS

The rise of water levels in trenches 11-14 after the summer of 1978 does not seem attributable to ground-water seepage but is apparently caused by the infiltration of water through the cover, presumably through cracks. The water levels in trenches 11-14 changed after a long, dry summer (driest summer since at least 1971), which may have extended dissication cracks deeper than normal so that the cracks either penetrated the cover or intersected subsidence cracks produced by collaspe of the refuse. Records of water-level trends in trenches 3-5 after the dry summer of 1971 suggest that once cracks extend through the cover and are thus open bottomed, they do not close completely, even during wet periods. The increased infiltration of water through the cover does not seem to be related to trench pumpdowns.

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