

1. An aboveground ash monofill was constructed over the natural sloping ground with little modification. Perimeter ditches were installed to control surface water. During operation and immediately after a rain, 40,000 m³ of ash washed out of the landfill. How could this happen? (10 %)
2. A rotary kiln designed for a nominal heat release of 15,000 Btu/hr-ft³ has an inside diameter of 8 ft and is 30 ft long.
 1. Determine the design heat release in Btu/hr. (5 %)
 2. Occasionally a waste consisting of polyethylene pellets is "batch" fed to the kiln in 30 gallon fiber containers. The pellets have a bulk density of 50 lb/ft³ and a heating value of 18,000 Btu/lb. A single container is consumed in 6.5 minutes.
 - (a) Will the kiln operate within its design parameters? (5 %)
 - (b) What kind of combustion would you expect? (5 %)
 - (c) How would you correct the problem if you were the operator? (5 %)
3. The mixture described below is being incinerated at 2,000 °F with 50 % excess air and a residence time of 2.1 seconds. Principal Organic Hazardous Constituents (POHCs) for this waste are benzene, chlorobenzene, and toluene. The flow rate of gas from the incinerator is measured at 12,500 dscfm (dry standard cubic feet per minute). The O₂ concentration in the flue gas is 7.0 %.

Compound	Formula	Mol. wt.	Inlet (lb/hr)	Outlet (lb/hr)
Benzene	C ₆ H ₆	78.11	2015	0.537
Chlorobenzene	C ₆ H ₅ Cl	112.5	1150	0.109
Ethylbenzene	C ₈ H ₁₀	106.17	2230	0.757
Toluene	C ₇ H ₈	92.10	637	0.022
Xylene	C ₈ H ₁₀	106.17	3040	1.25
Hydrochloric acid	HCl	36.45	0	10.7
Particulates				23.4

1. Calculate DRE for all of the organic compounds. (10 %)
2. Determine if this emission meets requirements for:
 - (a.) POHCs
 - (b.) Particulates
 - (c.) HCl

(背面仍有題目,請繼續作答)

4. A waste stream of 20,000 gal/day contains 270 mg/L of cyanide as NaCN. Determine the theoretical (Stoichiometric) amount of chlorine required daily to destroy this waste. (10 %)
5. An engineer proposes that metal-plating sludges be disposed of in a municipal waste landfill. To demonstrate the safety of the proposal, the engineer predicted leachate concentrations based on a laboratory test. The test involved drying and pulverizing the sludge, adding distilled water (proportional to the ratio between the mass of sludge to be landfilled and the total pore volume of the landfill), and stirring the mixture for 90 days. Would this test be expected to yield conclusive predictions of worst case leachate concentrations? (10 %)
6. Identify the sources of volatile emissions from a lagoon and a landfill. (15 %)
7. Nickel is removed from a plating waste stream by hydroxide precipitation at pH=10. Determine the solubility of nickel in pure water at 25 °C $K_{sp}=5.54 \times 10^{-16}$. (10 %)