Refractory pollutants are solids which are difficult to remove by common processes. In this case, the term "refractory" is used to mean "stubborn."

4 DISINFECTION

Chlorine gas is the least expensive, and therefore the most common, method of disinfecting wastewater. However, chlorine gas is toxic, corrosive, and displaces oxygen since it is heavier than air. Chlorine gas also lowers the pH of the water, favoring the formation of combined residuals.

Because of these disadvantages, alternatives to chlorine gas need to be considered when recommending the disinfection method.

- **Hypochlorites**: Both sodium and calcium hypochlorite are solids that dissolve in water. They have a limited shelf life, and are susceptible to photodecomposition. Hypochlorites are less effective and slightly more expensive than chlorine gas.
- **Chlorine Dioxide Gas**: Cl_2O is explosive and must be generated on-site. It reacts with many compounds, requiring larger doses than chlorine gas. However, it combines with organics without combining with ammonia.
- **Ozone Gas**: Ozone is one of the most effective oxidizing agents. In addition to its disinfection capabilities, ozone also increases the dissolved oxygen content of water. Ozone is toxic and corrosive. It must be generated at the point of application. Because of its very short half-life, step feeding is required to obtain the necessary contact period.
- **Exotics**: Other methods exist, but are typically high in cost. These exotic alternatives include bromine (bromine chloride), iodine, silver oxide, gamma radiation, and ultraviolet radiation.

5 TYPICAL COMPOSITION OF DOMESTIC SEWAGE

Not all sewage flows are the same. Some sewages are stronger than others. Table 8.5 lists typical values for strong and weak domestic sewages. A medium classification would be approximately midway between the values for strong and weak.

6 WASTEWATER QUALITY STANDARDS

Applicable wastewater quality standards have been set by both the Water Pollution Control Act and the Environmental Protection Agency. General standards set by the Water Pollution Control Act are given in table 8.6. These standards must be met by facilities that receive federal funding.

The EPA's standards for secondary treatment are given in terms of 5-day BOD, suspended solids, coliform count, and pH. Table 8.7 presents typical values.

Table 8.5
Strong and Weak Domestic Sewages

(All concentrations in mg/l unless noted.)

constituent	strong	weak
solids, total	1200	350
dissolved, total	850	250
fixed	525	145
volatile	325	105
suspended, total	350	100
fixed	75	30
volatile	275	70
settleable solids, (ml/liter)	20	5
biochemical oxygen demand, 5-day, 20°C	300	100
total organic carbon	300	100
chemical oxygen demand	1000	250
nitrogen, (total as N)	85	20
organic	35	8
free ammonia	50	12
nitrites	0	0
nitrates	0	0
phosphorus (total as P)	20	6
organic	5	2
inorganic	15	4
chlorides	100	30
alkalinity (as $CaCO_3$)	200	50
grease	150	50

7 DESIGN FLOW QUANTITY

Approximately 70 to 80% of a community's domestic and industrial water use will return as wastewater. This water is discharged into the sewer systems, which may be different or the same as storm drains. Therefore, the nature of the return system must be known before sizing can occur.

Sanitary sewer sizing can often be based on an average of 100–125 gpcd. There will be variations with time in the flow, although the variations are not as pronounced as they are for water supply. Table 8.8 lists peak multipliers for treatment plant influent volume. Due to storage in ponds, clarifiers, and sedimentation basins, these multipliers may not be applicable throughout all processes in the treatment plant.