



**FIGURE 3.3** Elements of the power plant cycle for vapor-dominated geothermal resources. The steam is directed by the main steam line into a turbine that spins the connected generator unit, typically generating electricity at 13.8 kilovolts (kV), which a transformer increases to 230 kV for distribution by a transmission line. The steam leaving the turbine enters the condenser that contains a network of tubing through which cool water is circulated, facilitating the condensation process. The condensate is then pumped to the cooling tower where it is cooled by evaporation, with the cooled water being in part recirculated by the circulating water pumps back to and through the condenser. Because some noncondensable gases usually occur naturally in the steam, those gases are removed from the condenser by the gas ejector system that creates a partial vacuum by the flow of a small amount of steam delivered by the auxiliary steam line. Those gases, in particular  $\text{H}_2\text{S}$ , are chemically processed commonly by a Stretford System before delivery to the cooling tower where they are vented. SOURCE: Adapted from the Northern California Power Agency.

the geothermal development operations were taking place. As the area of steam field development expanded, the areal distribution of seismic events similarly expanded, and the number of the events progressively increased (Figure 3.4).

With the addition of more seismometers of increased sensitivity distributed throughout the expanded development area, a clear association became evident between these induced events and the active injection wells and volume of water being injected. Figure 3.5 shows where injection took place in the southeastern part of The Geysers in 1998, the year following the startup of the first wastewater pipeline that more than doubled the injection volume. During 1997-1998, 1,599 events of  $M \geq 0.6$  were recorded, an increase of just over 50 percent compared to the prior 12 months.

The history of steam production, water injection, and seismic history at The Geysers since 1965 is shown in Box 3.1. Steam production and therefore electricity generation reached a maximum in 1987, followed by a fairly rapid decline until the wastewater pipelines