# 1979 EPA Air Quality Ozone Standard

- Probabilistic formulation: The expected number of days per calendar year the maximum hourly ozone concentration exceeds 0.12 ppm should be $\leq 1$.
- Implementation: If the average number of exceedances over three years is > 1 (i.e, total > 3) , the site is declared not in compliance.

# Reformulation as Statistical Decision Rule

- X = number of exceedances in 3 years
- $H_0$: E(X) = 3 (just in compliance),
- $H_a$: E(X) > 3 (not in compliance)
- Reject $H_0$ if X > 3
- $\alpha$ = P(X > 3| E(X) = 3)
- $\alpha$ = probability of Type I error ( = probability of incorrectly rejecting $H_0$)

# Binomial Model

- Each day is a trial: exceedance is "success"
- n = 3X365 = 1095 trials (assuming no leap year)
- If $H_0$ is true, 3 = E(X) = np => p = 1/365
- Possible criticisms of model?
- Is the normal approximation appropriate?

# Calculating $\alpha$

- Use "exact" binomial test: P(X = k) = ?
- $\alpha$ = P(X > 3) = P(X $\geq$ 4)
- = 1- P(X < 3)
- = 1 - P(X = 0) - P(X = 1) - P(X = 2) - P(X = 3)
- Is this a good decision rule?