For any two flavors there is a triplet of observable oscillations.

$$P(\nu_\mu \to \nu_e) \cong 4\left|U_{\mu 4}\right|^2 \left|U_{e4}\right|^2 \sin^2\left(\frac{\Delta m^2_{41} L}{4E}\right) = \sin^2 2\theta_{\mu e} \sin^2\left(\frac{\Delta m^2_{41} L}{4E}\right)$$

$$P(\nu_\mu \to \nu_\mu) \cong 4\left|U_{\mu 4}\right|^2 (1-\left|U_{\mu 4}\right|^2) \sin^2\left(\frac{\Delta m^2_{41} L}{4E}\right) = \sin^2 2\theta_{\mu\mu} \sin^2\left(\frac{\Delta m^2_{41} L}{4E}\right)$$

$$P(\nu_e \to \nu_e) \cong 4\left|U_{e4}\right|^2 (1-\left|U_{e4}\right|^2) \sin^2\left(\frac{\Delta m^2_{41} L}{4E}\right) = \sin^2 2\theta_{ee} \sin^2\left(\frac{\Delta m^2_{41} L}{4E}\right)$$

$$P(\nu_\alpha \to \nu_\alpha) \approx P(\nu_\alpha \to \nu_s)$$

For small mixing

$$\sin^2 2\theta_{\mu e} = \frac{1}{4} \sin^2 2\theta_{\mu\mu} \sin^2 2\theta_{ee} \quad \text{and} \quad \theta_{\mu\mu} \sim \theta_{24} \quad \theta_{ee} \sim \theta_{14}$$

This gives an upper bound after averaging over the oscillations

$$P(\nu_\mu \to \nu_e) \leq \frac{1}{2} P(\nu_\mu \to \nu_\mu) \times P(\nu_e \to \nu_e)$$

Although derived for 3+1 this should be independent of number of sterile neutrinos.

Regardless, the triplet of oscillations must be consistent if appearance is found.

Each of the disappearances separately is allowed without appearance.