

QUESTION 11

A 10 ton net weight (9071 kg) cylinder of 5% enriched UF₆ is punctured during heating inside a fuel fabrication facility. The facility building ventilation is released to the atmosphere via a 25 meter tall stack. The building has a volume of 10⁶ cubic feet and a stack flow rate of 10⁴ cfm.

GIVEN

$$T_{1/2}^{234}\text{U} = 2.5 \times 10^5 \text{ y}$$

$$T_{1/2}^{235}\text{U} = 7.1 \times 10^8 \text{ y}$$

$$T_{1/2}^{238}\text{U} = 4.5 \times 10^9 \text{ y}$$

The mass of the ²³⁴U is 1% of the mass of the ²³⁵U.

Atomic mass of Fluorine = 19 amu

Graphs of σ_y and σ_z with respect to distance are attached.

POINTS

- 20** A What is the specific activity of the UF₆? **Show all work.**
- 20** B For this part only, assume a specific activity of 10⁻⁵ Ci/g. Calculate the initial release rate (in activity units) for U_{Total} assuming instantaneous release of the contents of the UF₆ cylinder and instantaneous uniform mixing of the UF₆ within the building. **Show all work.**
- 25** C Using a constant release rate of 3.32 x 10⁻⁴ Ci/s, calculate the activity concentration of U_{Total} at 500 meters downwind at ground level at plume centerline for class D stability conditions and 5 m/s wind speed using the Gaussian plume model equation. **Show all work.**
- 20** D List five control measures that can be used to preclude a criticality accident from occurring. **Number your responses. Only the first five will be graded.**
- 15** E Preliminary analysis of the stack monitoring shows that apparent releases were considerably lower than predicted. Give three explanations for this. **Number your responses. Only the first three will be graded.**

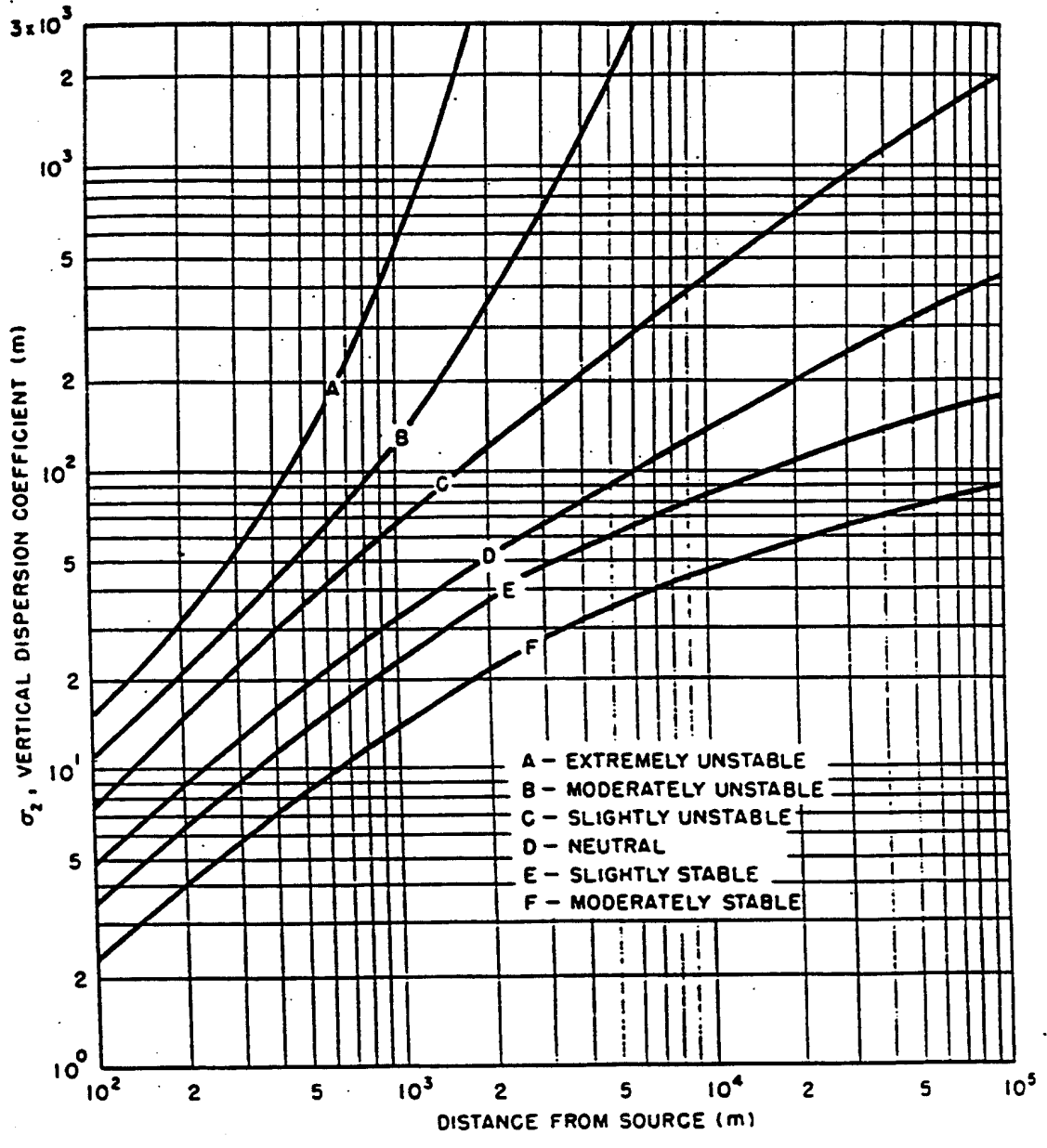


Figure 1: Meteorology and Atomic Energy: σ_z versus distance

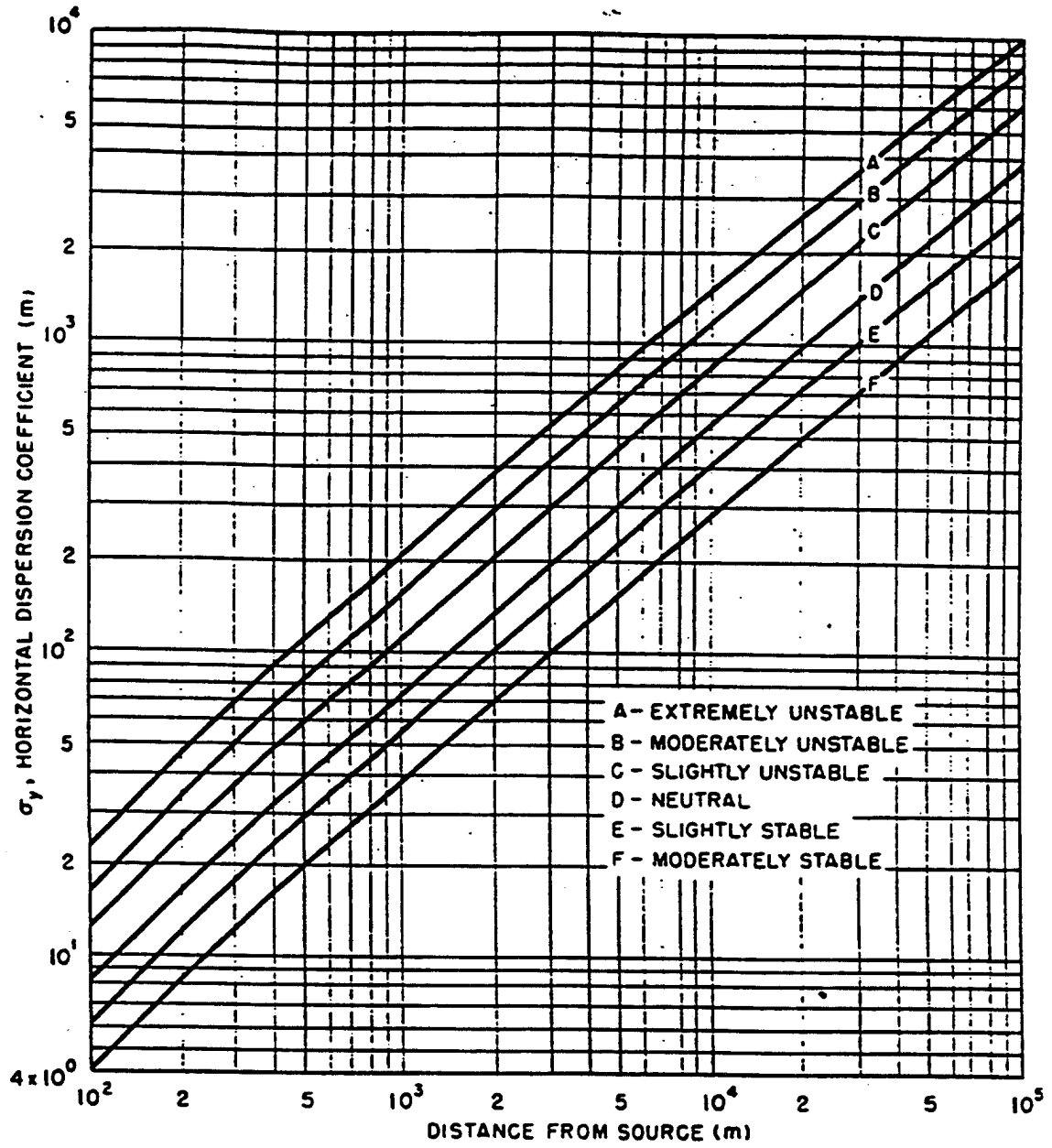


Figure 2: Meteorology and Atomic Energy: σ_y versus distance