For the O-ring, from Parker O-ring handbook, leakage, L, is approximated by the following formula:

$L := 0.7 FDPQ(1 - S)^2$ n std. cc/sec; for quantities given:

$F := 3 \cdot 10^{-8} \; \frac{cc(std)\,cm}{cm^2 s \cdot bar}$ (.6-3.0) for Xe through nitrile or butyl rubber, 25C NASA, via Parker hdbk

$D := 48$ in

$P := 225$ psi

$Q := 1.5$ dimensionless squeeze factor , from fig 3-11

$S := .2$ squeeze, percentage expressed as decimal

Leak rate, per O-ring

$L := 0.7 \cdot F \cdot D \cdot P \cdot Q \cdot (1 - S)^2$ $L = 2.177 \times 10^{-4}$ std cc/sec per O-ring $M_{a\_Xe} \cdot L \cdot scc \cdot s^{-1} = 41.715 \frac{gm}{yr}$

Molar flow, both O-rings

$Q_{Xe\_O\_ring} := 2 \cdot L \cdot scc \cdot s^{-1}$ $Q_{Xe\_O\_ring} = 1.944 \times 10^{-8} \frac{mol}{s}$

Mass flow:

$M_{Xe\_O\_ring} := Q_{Xe\_O\_ring} \cdot M_{a\_Xe}$ $M_{Xe\_O\_ring} = 0.083 \frac{kg}{yr}$