Dimensional Consistency and Risk Interpretation of the Omega.limit Model

# 1. Introduction

This document analyzes the dimensional consistency and interpretation of the Omega.limit-based cancer risk model. The model calculates the energetic risk level of a cell by comparing the measured energy transition rate (dE/dt) to the tissue-specific tolerance threshold (Ω\_limit = λ × Ω).

# 2. Energy Transition Rate (dE/dt)

The energy transition rate dE/dt represents the rate of energy processed by a cell over time. It is measured in SI units as Watts (W):

dE/dt = Watts = kg·m²/s³

# 3. Omega.limit Threshold and Dimensional Match

Omega.limit is defined as a product of a tissue-specific tolerance factor λ and a proposed universal constant Ω:

Ω\_limit = λ(t) × Ω

If Ω is expressed in Watts, both dE/dt and Ω\_limit share the same dimensional unit (Watts).

This results in a dimensionless risk ratio:

Risk = (dE/dt) / (λ × Ω) → W / W = dimensionless

# 4. Risk Interpretation

When both numerator and denominator are expressed in the same unit (Watts), the resulting ratio is unitless and can be interpreted as a relative measure of energetic stress:

• Risk < 1 → Cellular energy use is within safe tolerance (stable)

• Risk ≈ 1 → Borderline energetic stress (monitoring required)

• Risk > 1 → Energy exceeds tolerance threshold (potential instability or tumorigenic risk)

# 5. Example Calculation

Given:

dE/dt = 2.1 W

Ω\_limit = λ × Ω = 1.2 × 1.5762 = 1.8914 W

Then:

Risk = 2.1 / 1.8914 ≈ 1.11

Interpretation: Risk exceeds threshold by 11%, indicating increased energetic instability.

# 6. Conclusion

The Omega.limit model is dimensionally consistent when the constant Ω is defined in Watts, matching the unit of dE/dt. This allows for valid and scientifically sound comparisons between energy production and cellular tolerance limits. The resulting dimensionless risk function provides actionable insight for identifying unstable energetic states.