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The Radsetta Stone – Establishing a Common Environment Taxonomy Across Space Nuclear Technologies

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Qualitative descriptions, such as “high temperature” or “long exposure” vary substantially according to the context and can obfuscate messaging. A quantitative taxonomy for describing space nuclear environments - encompassing fission, radioisotope, and natural - has been established to enable clear communication across technology applications. Zones have been defined to partition environments with an intent to achieve a useful level of granularity. These zones enable a more detailed assessment than the Technology Readiness Level and can also be used to identify gaps and overlaps spanning space nuclear technologies. This framework has been named the Radsetta Stone – a paronomasia of the Rosetta Stone.

There are two directions in which the Radsetta Stone can be used. The user may be a technology developer or a technology customer. The developer would use the Radsetta Stone to communicate the current state of the technology they are developing. The maximum zone for each parameter would then be used to state the current limit of their technology. The customer could use the Radsetta Stone to communicate the environmental conditions of their system. Zones would be associated with different locations within the system. The Radsetta Stone is intended to enable clear communication regarding space nuclear technology.

The following legend and tables show the levels of the Radsetta Stone. These levels show success criteria gates in a similar manner as Technology Readiness Levels.

Symbol	Parameter	Unit
T	Temperature	K
Φ_{nt}	Neutron fluence below 100 keV	particle/cm^2
Φ_{nf}	Neutron fluence above 100 keV	particle/cm^2
D_γ	Ionizing γ dose	krad
LET_{th}	Linear energy transfer threshold for effect at 1E7 ions/cm^2	MeV-cm^2/mg
a	Acceleration	g
P	Pressure	Torr
Chem	Chemical compatibility	N/A
t	Exposure time	s

T
< 30
< 77
< 150
< 200
295
< 400
< 800
< 1400
< 2000

Φ_{nt}
N/A
< 1E5
< 1E7
< 1E9
< 1E11
< 1E14
< 1E18
< 1E21
< 1E24
< 1E27

Φ_{nf}
N/A
< 1E5
< 1E7
< 1E9
< 1E11
< 1E14
< 1E18
< 1E21
< 1E24
< 1E27

D_γ
N/A
< 1E2
< 1E3
< 1E4
< 1E5
< 1E6
< 1E7
< 1E8
< 1E9
< 1E10

LET_{th}
N/A
< 10
< 20
< 37
< 75
< 100

a
N/A
< 1
< 7
< 15
< 20
< 40
< 60

P
< 1E-5
< 1E-3
< 1E-1
760
< 1E3
< 1E4
< 1E5

Chem
N/A
Highly oxidizing
Moderately oxidizing
Neutral
Moderately reducing
Highly reducing

t
< 6E1
< 4E2
< 9E4
< 6E5
< 3E6
< 3E7
< 3E8