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*will never
be estimated.*

Application of radiobiology to hazard evaluation depends on many uncertain factors. Among these are (1) the extrapolation of data obtained from one biological system or species to another; (2) the great problem of interpreting physical measurement of radiation dose and applying this same dose concept to the effect on the biological tissue; (3) the determination of an acceptable dose measurement for both the physicist and the biologist, the problem of measuring an energy transfer at one point and extrapolating this dose to another system at some other point; and (4) perhaps the greatest difficulty of describing a given phenomenon in a biological system as a radiation effect when the biological system is certainly a dynamic, complex, everchanging system which has the capability of receiving injury and subsequently of performing a certain degree of physiological recovery.

*See last P Hechler's:
electrons don't cause cataracts.*

EXPECTED (CONT)

MEDICAL EFFECTS* - APOLLO 8 RADIATION

LATE EFFECTS *1-2 years* *60 days - year*

*non specific
non threshold
dose rate dependent.
severity time inversely to dose*

MISSION RADIATION	CATARACTS	SKIN DEATH - SCARRING	STATISTICAL LIFE SHORTENING	GENETIC EFFECTS
VAN ALLEN BELT TLI AND TEI	0	0	$\cong 0$	NOT SIGNIFICANT
COSMIC RAY	0	0	$\cong 0$	
NUCLEAR TESTING	0	0	0	
SUN FLARE	0	0	0	
TOTAL	0	0	$\cong 0$	

* IN LAYMAN Terminology

EXPECTED ^{Nominal} MEDICAL EFFECTS* - APOLLO 8 RADIATION

EARLY EFFECTS (30-60 days)
 (1-10 days)

Threshold phenomena.
 Lightly dose rate dep.
 but not in non-linearly
 in dose.

MISSION RADIATION	MAX RAD DOSE		SKIN ^{has to be kept}		BLOOD CELLS DECREASED	NAUSEA - VOMITING	EARLY DEATH
	SKIN	DEPTH	SEVERE RED-DENING	ULCER-ATION			
VAN ALLEN BELT TLI AND TEI	0.09	0.01	0	0	0	0	0
COSMIC RAY	0.08	0.08	0	0	0	0	0
NUCLEAR TESTING	0	0	0	0	0	0	0
SUN FLARE	0	0	0	0	0	0	0
TOTAL	0.17	0.09	0	0	0	0	0

(2)

(1)

* IN LAYMAN TERMINOLOGY

CONTINGENCY

MEDICAL EFFECTS* - APOLLO 8 RADIATION

EARLY EFFECTS

MISSION RADIATION	MAX RAD DOSE		SKIN		BLOOD CELLS DECREASED	NAUSEA - VOMITING	EARLY DEATH
	SKIN	DEPTH	SEVERE RED-DENING	ULCER-ATION			
VAN ALLEN BELT TLI AND TEI	2.0	1.0	0	0	0	0	0
COSMIC RAY	0.2	0.2	0	0	0	0	0
HIGH ALTITUDE NUCLEAR TESTING	200	10	< 5 PERCENT	0	SLIGHT	0	0
SUN FLARE	237	15	< 5 PERCENT	0	SLIGHT	0	0
2X (WORST CASE)	474	30	~15 PERCENT	0	~ 20 PERCENT	0	0

* IN LAYMAN Terminology

CONTINGENCY (CONT)
MEDICAL EFFECTS* - APOLLO 8 RADIATION
LATE EFFECTS

MISSION RADIATION	CATARACTS	SKIN DEATH - SCARRING	STATISTICAL LIFE SHORTENING	GENETIC EFFECTS
VAN ALLEN BELT TLI AND TEI	0	0	≈ 0	NOT SIGNIFICANT
COSMIC RAY	0	0	≈ 0	
HIGH ALTITUDE NUCLEAR TESTING	$p \geq 0$	0	≈ 100 DAYS	
SUN FLARE	$p \geq 0$	0	≈ 150 DAYS	
2X (WORST CASE)	$p \leq 0.5$	0	≈ 300 DAYS	

* IN LAYMAN Terminology