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*midway
to estimate.*

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 *60 days - yrs*

*non specific
non threshold
low dose rate dependent.
severity time inversely \propto dose*

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	
NUCLEAR TESTING	0	0	0	
SUN FLARE	0	0	0	
TOTAL	0	0	≈ 0	

* in LAYMAN Terminology

Nominal
EXPECTED
MEDICAL EFFECTS* - APOLLO 8 RADIATION

*Threshold phenomena.
 Lightly dose rate dep.
 mis see via non linearity
 in dose.*

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

MISSION RADIATION	MAX RAD DOSE		SKIN		BLOOD CELLS DECREASED	NAUSEA - VOMITING	EARLY DEATH
	SKIN	DEPTH	<i>has to be exp.</i> SEVERE RED-DENING ULCER-ATION				
			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 hrs. 2-8 hrs.

(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	$\cong 0$	NOT SIGNIFICANT
COSMIC RAY	0	0	$\cong 0$	
HIGH ALTITUDE NUCLEAR TESTING	$p \cong 0$	0	$\cong 100$ DAYS	
SUN FLARE	$p \cong 0$	0	$\cong 150$ DAYS	
2X (WORST CASE)	$p \cong 0.5$	0	$\cong 300$ DAYS	

* IN LAYMAN TERMINOLOGY