REVISED SKIN DOSE LIMIT
10 CFR PART 20

Definitions: Shallow dose equivalent

? Old definition

the dose equivalent at a tissue depth of 0.007 centimeters averaged over an area of 1 square centimeter

? New definition

the dose equivalent at a tissue depth of 0.007 centimeters

Dose Limit

Old limit

50 rem shallow-dose equivalent to the skin or to any extremity

New limit

50 rem shallow-dose equivalent to the skin or to any extremity

Compliance

? Old System

The assigned …. shallow-dose equivalent must be for the part of the body receiving the highest exposure

? New System

The assigned …. Shallow-dose equivalent must be the dose averaged over the 10 contiguous square centimeters of skin receiving the highest exposure

Enforcement

Old system

A distinction was made between hot particles and other skin exposures. Hot particles were subject to enforcement discretion through an interim enforcement policy

New system

There is no longer a distinction between hot particle exposures and any other type of skin exposure. The interim enforcement policy is no longer in effect

BASES FOR THE REVISED SKIN DOSE LIMIT

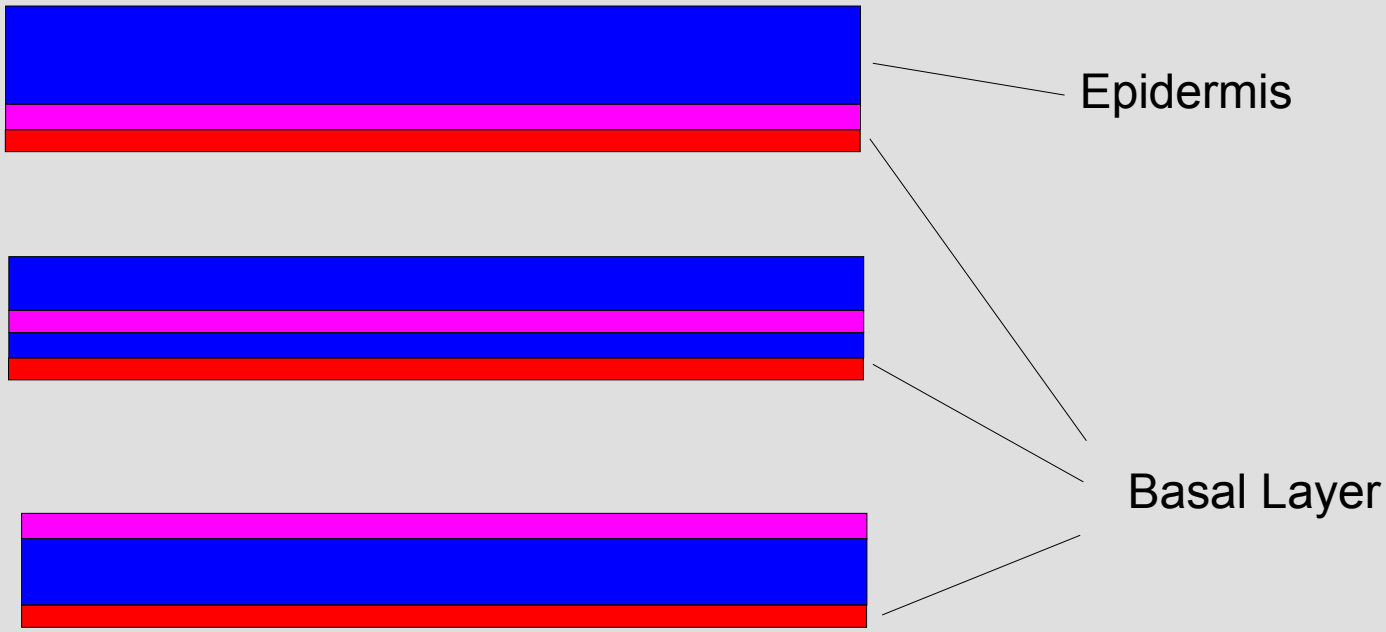
From the Statements of Consideration

Given exposures at the proposed skin dose limit ….. The worst-case deterministic effects are a 5% probability of erythema if all of the dose …… were delivered to an area of 2.5 square centimeters ……

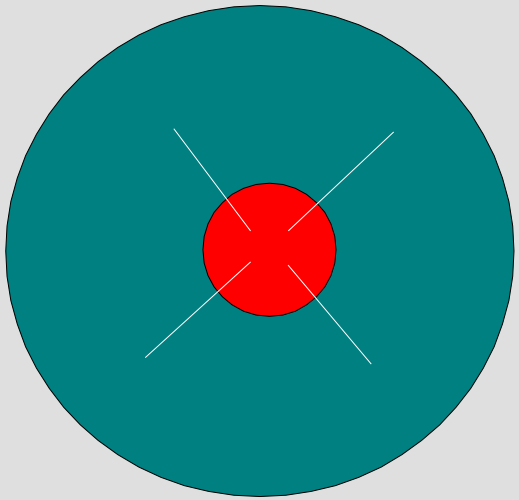
…. and a 50-percent probability that measurable dermal thinning would be observable if all the dose were delivered to an area of <0.5 square centimeters …..

……. The worst case probability of producing a barely detectable scab as a result of acute cell killing was estimated to be 10 percent for a cobalt-60 or activated fuel hot particle located about 0.4 mm off the skin.

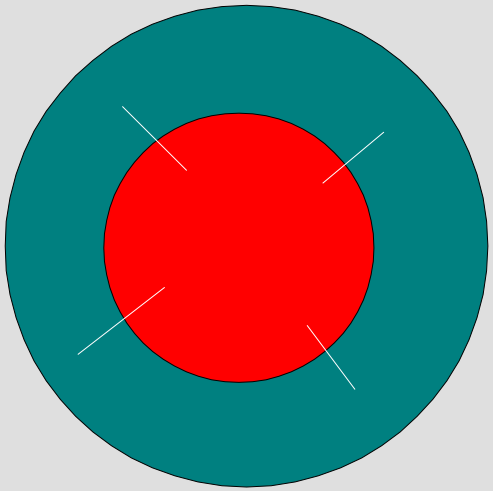
Importance of contiguous skin area for estimating dose



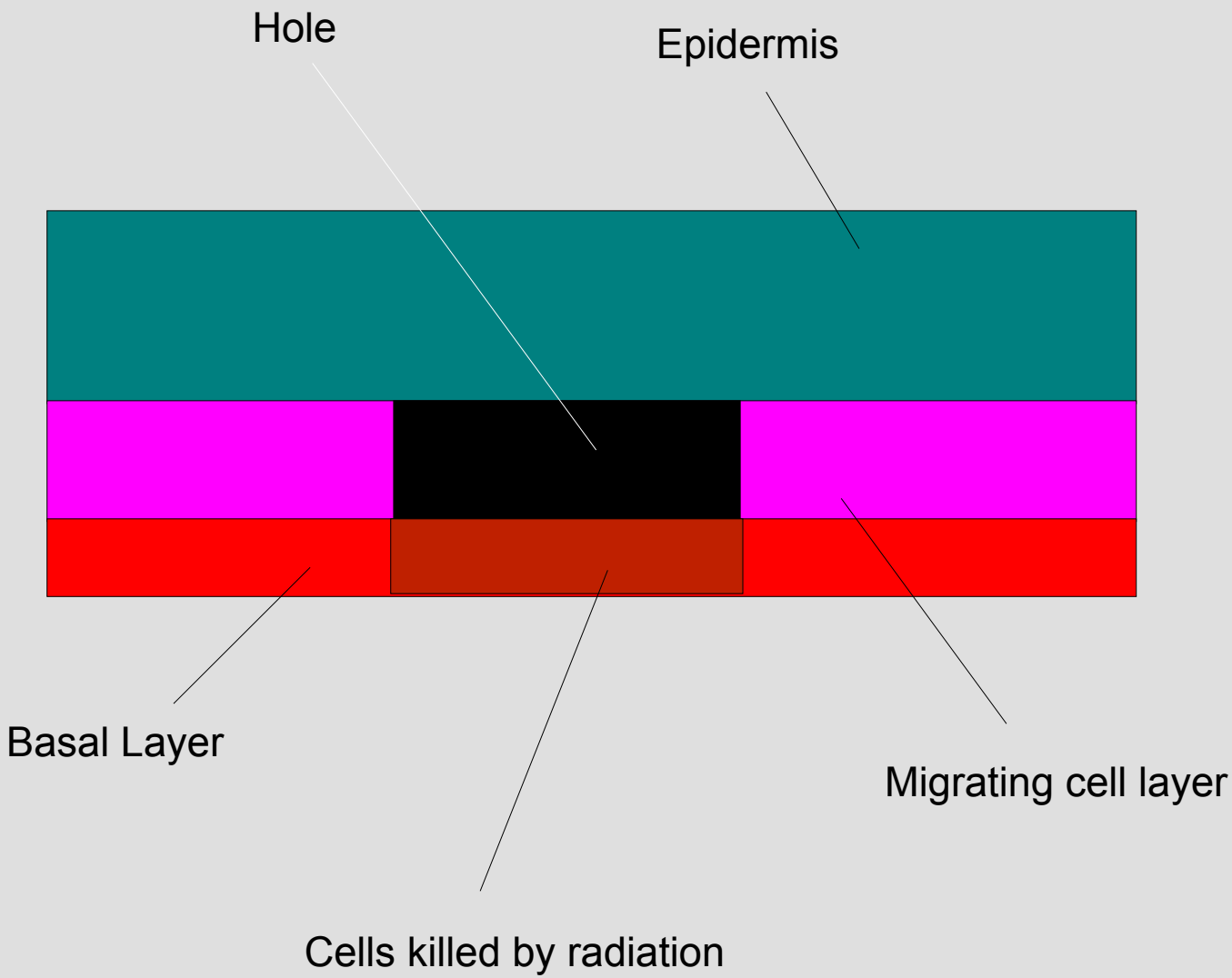
Epidermis cycle time: about 3 weeks



High dose to produce an ulcer



Lower dose to produce the same ulcer


Hole
Epidermis
Basal Layer
Migrating cell layer
Cells killed by radiation

Why the new rule ?

? Reduction in overly conservative use of protective clothing

? Reduction in non-radiological health hazards (heat stress, accidents)

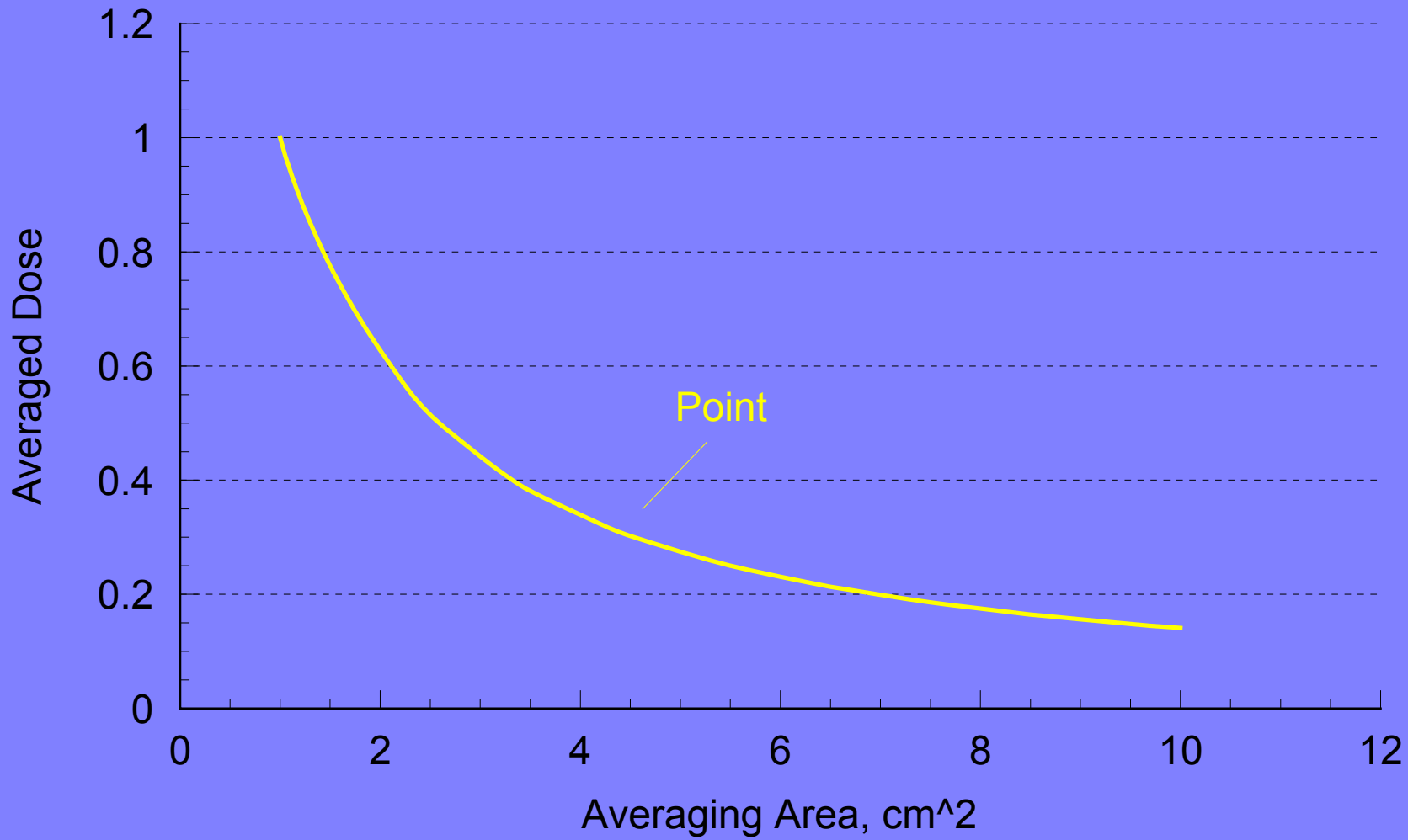
? Reduction of time in restricted areas

? Reduction in whole body dose and stochastic risk (cancer)

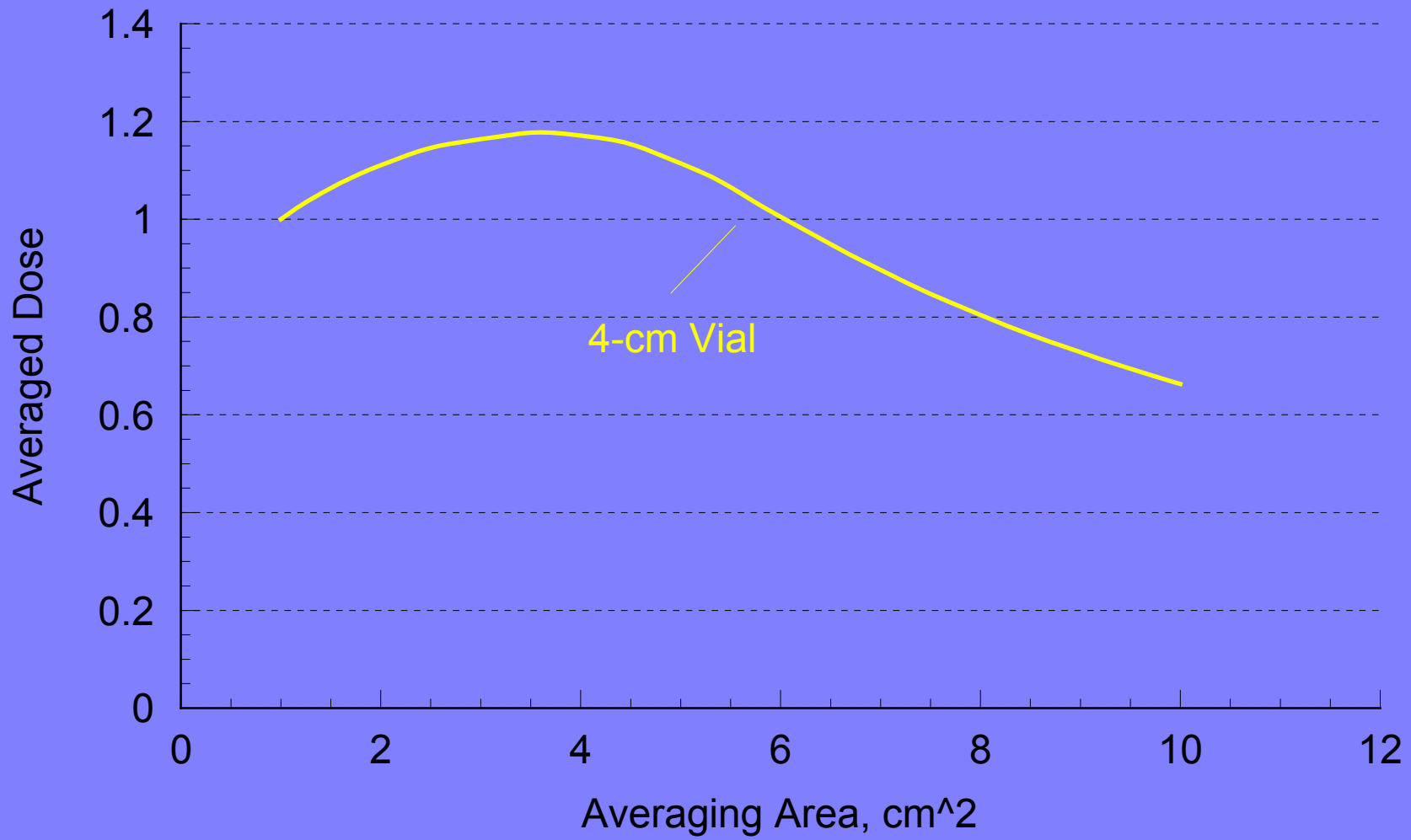
? Reduction of job loss because of point contaminations

? A limit that is more closely linked to risk

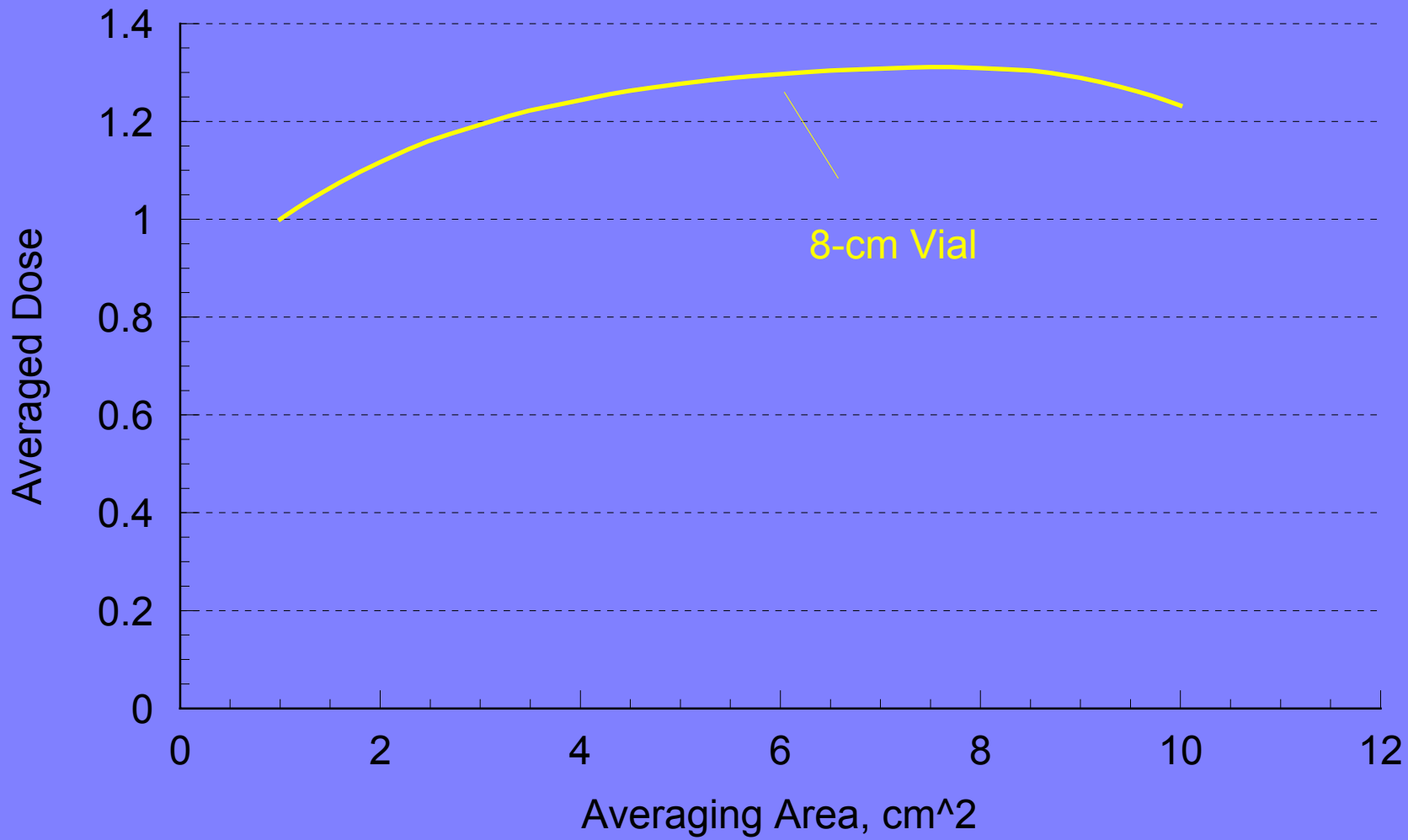
EFFECT OF CHANGING THE AVERAGING AREA


1.2
1
0.8
0.6
0.4
0.2
0
Averaged Dose
Point
0
2
4
6
8
10
12
Averaging Area, cm^2

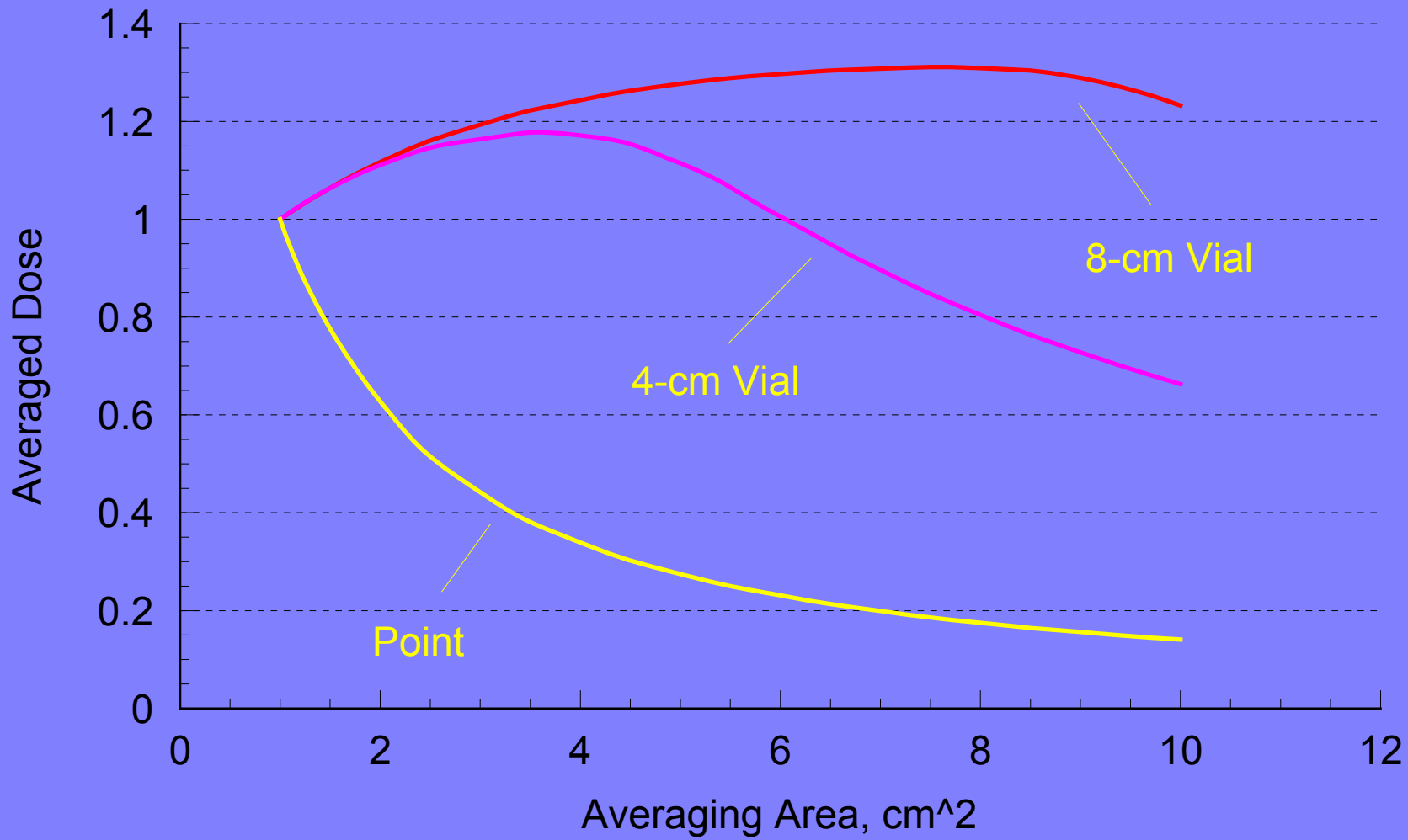
E = 1.0 MeV


1.4
1.2
1
0.8
0.6
0.4
0.2
0
Averaged Dose
0
2
4
6
8
10
12
Averaging Area, cm^2
4-cm Vial

E = 1.0 MeV

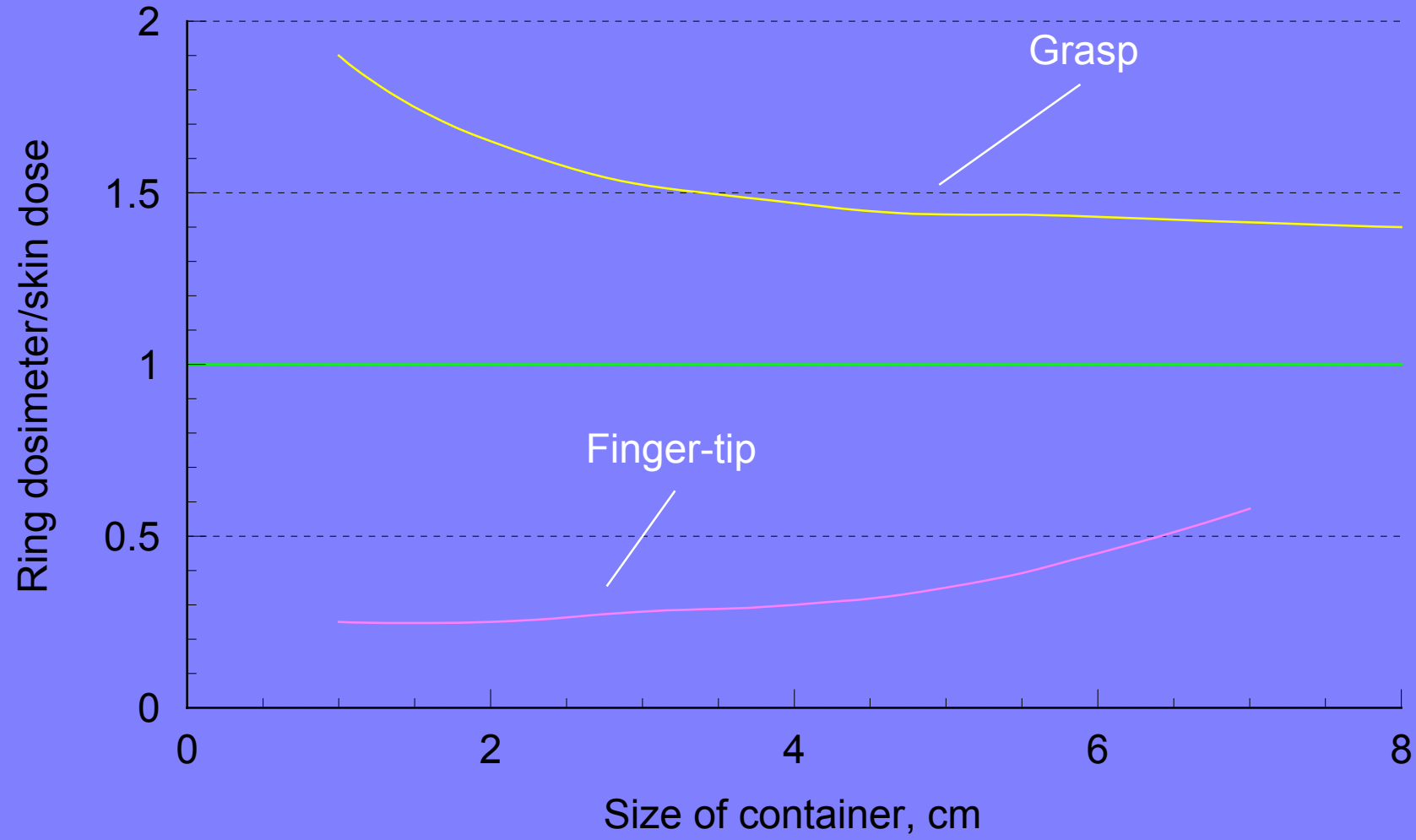

1.4
1.2
1
0.8
0.6
0.4
0.2
0
Averaged Dose
0
2
4
6
8
10
12
Averaging Area, cm^2
8-cm Vial

E = 1.0 MeV

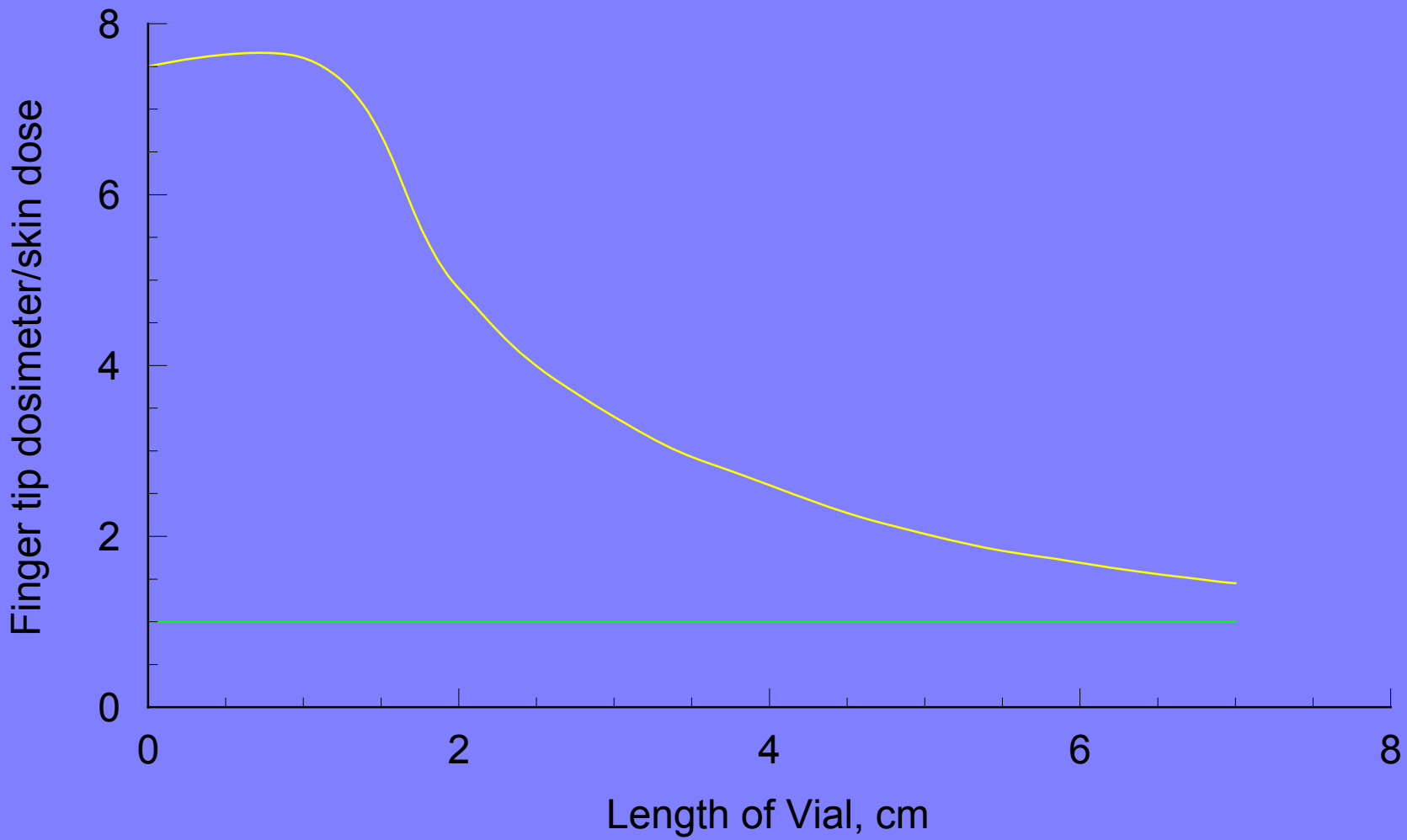

1.4
1.2
1
0.8
0.6
0.4
0.2
0
Averaged Dose
0
2
4
6
8
10
12
Averaging Area, cm^2
8-cm Vial
4-cm Vial
Point

E = 1.0 MeV

EFFECT ON RING DOSIMETER MEASUREMENTS


Grasp
Finger-tip
Ring dosimeter/skin dose
Size of container, cm
0
0.5
1
1.5
2
0
2
4
6
8

E = 1.0 MeV


Finger tip dosimeter/skin dose
0
2
4
6
8
0
2
4
6
8
Length of Vial, cm

E = 1.0 MeV

Conclusions

The new skin dose rule operates much closer to the deterministic threshold than the old rule.

Therefore, caution is required.

If annual doses are a small fraction of the limit, the accuracy of dose measurements need not be great.

However, if the doses represent a substantial fraction of the limit, care must be taken to ensure reasonable accuracy. Allowances for inaccuracies must be made through the use of conservative measurements.

The ring dosimeter tends to underestimate the skin dose in situations where the source is handled with the finger tips.

Therefore, a correction factor must be applied to the dosimeter reading in such geometries.

The ring dosimeter tends to overestimate the skin dose in situations in which the source is grasped with the hand.

Therefore, no correction factor need be applied to the ring dosimeter reading in such geometries.

Compliance requires assessment of the dose to the highest exposed 10 square centimeters of skin for the entire monitoring year, and not for single operations.

Therefore, the need for a correction factor on the ring dosimeter, and the size of that factor, depends on the mix of activities engaged in by the worker.

Some workers may engage in a mix of activities that results in a dosimeter reading that does not require a correction factor for the monitoring year. Others who engage in a narrow range of procedures may require a correction factor.

The licensee must make this determination, depending on its local conditions.

THE END