

**Overview of NUREG-1391  
As it Relates to Soluble Uranium  
Limits that Might be Applied  
Under 10 CFR Part 70**

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# Background

- The document
  - Published February 1991
  - NRC Office of Nuclear Regulatory Research
- Purpose
  - Report prepared in anticipation of Part 76 rulemaking for uranium enrichment plants (design and siting criteria).
  - Compare early chemical effects from acute exposure to  $UF_6$  to whole body and thyroid exposure limits in 10 CFR 100 “Reactor Site Criteria”
  - Rulemaking notice - “The staff ... Proposes using quantities or concentration values which are at the lower range or average threshold level for chemically toxic effects which, if exceeded, could cause transient or permanent injury.”
  - NMSS request - Uranium intake values equivalent to the dose limits “that would not cause significant nonstochastic effects.”

# The Effects of Radiation Doses in 10 CFR Part 100

- Limits
  - 25 rem whole body, acute
  - 300 rem thyroid, acute
- 300 rem thyroid considered to have less risk than 25 rem whole body
- Neither dose will “produce significant nonstochastic (deterministic) effects.”

# The Effects of Uranium Toxicity from Reviewed Research continued....

- Toxicologist panel review →
- Notes:
  - 40 mg value not supported by worker intake of 600 mg (no long-term effects)
  - 40 mg value not supported by worker intake of 260 mg (no long-term effects)

Health Effect	U intake (mg) by 70 kg person
50% lethality	230
Threshold for permanent renal damage	40
Threshold for transient renal injury (first observation of effects)	8.3
No effect (no observable effects)	4.3

# The Effects of Uranium Toxicity from Reviewed Research

- Toxicologist panel review (repeated for reference) →
- Notes:
  - 40 mg value not supported by animal research (no evidence of long-term injury or biochemical function changes)
  - 40 mg value not supported by two worker intakes of 80 – 100 mg (no long-term effects)
  - 8 mg value not supported by 8 worker intakes in the range 11-24 mg (no observable effects)

Health Effect	U intake (mg) by 70 kg person
50% lethality	230
Threshold for permanent renal damage	40
Threshold for transient renal injury (first observation of effects)	8.3
No effect (no observable effects)	4.3

# Extant NRC Uranium Toxicity Limits

- Notes:
  - 9.6 “still appropriate” for its application
  - 2 “larger safety margin that appropriate for comparison in this report”

Effect/Purpose	Acute U intake (mg)
No harmful effects (NRC 10 CFR 20.103(a)(2) - Based on ACGIH TLV) Note: now 10 CFR 20.1201(e)	9.6 per week
Intake level by offsite person requiring emergency plan (NRC 54 FR 14051- well below threshold at which effects could be observed) Note: now 10 CFR 70.22(i)	2

# Conclusion

- NRC's limit of 9.6 mg, rounded off to 10 mg, selected to be comparable to 25 rem radiation exposure
- Rationale: "Neither of these exposures conditions have significant acute effects to the exposed individual."

# Comments on the Conclusions

- The fact, which is well justified in the NUREG that the value chosen (10 mg) represents an exposure from which significant acute effects are not going to arise, does not make the values 10 mg and 25 rem equivalent, nor does it establish the validity of the values as thresholds for observable effects.
  - As an analogy, we might all agree that both an intake of 1 pCi of tritium and 1 gram of table salt are both values at which we would expect no significant observable effects. But, this does not make them equivalent in risk space (i.e., would acute intakes 10,000 times higher look equivalent?)



# Comments on the Conclusions

continued....

- The NUREG calls into question the validity of the 8.3 (or 10) mg value as a threshold for transient injury, and presents only one study addressing this low-level of exposure which does not support this low of a threshold.
- The NUREG did not support the validity of the 40 mg value as a threshold for permanent injury, and in fact, other than presenting it, conclude without exception, that it is not supported by any of the other studies reviewed.
- In short, the NUREG accomplished what it was designed to do, but does not provide a sound technical basis to accomplish what is needed for Part 70 performance requirements