



July 10, 2007
REL:07:024

U. S. Nuclear Regulatory Commission
Office of Nuclear Material Safety and Safeguards
Division of Fuel Cycle Safety and Safeguards
Fuel Manufacturing Branch
Attn: Peter J. Habighorst, Chief
Mail Stop E2 C40
Washington, D.C. 20555-0001

Dear Mr. Habighorst:

Subject: Usage of ICRP 66 in Determination of Soluble Uranium Intake Threshold

Ref.: 1. Letter, P.J. Habighorst to R.E. Link, "Reply to Responses to Request for Additional Information for AREVA NP – Richland Site-Wide Integrated Safety Analysis Summary Review", May 17, 2007.

AREVA has received and reviewed your referenced letter in which the NRC gave its rationale for maintaining 40 mg of soluble uranium as the threshold intake for a high consequence event. In NUREG-1391, the standard referenced by the NRC, the 40 mg threshold for permanent kidney damage is a derived limit based on a systemic burden of 0.3 mg/kg body weight, which totals 21 mg for a 70 kg (standard) man (as referenced in Table 2, Page 3 of NUREG-1391). As AREVA has permission from the NRC to use and does use ICRP 66 for calculating doses for workers and for determining 10 CFR 20 Table 2 equivalents, AREVA also believes that the 21 mg threshold should be derived using the improved model, ICRP 66, instead of ICRP 30 as used in NUREG-1391. Based upon IMBA-URAN, which in turn is based upon ICRP 66, an intake of approximately 75 mg of soluble uranium would be required to produce a systemic burden of 21 mg. The attached sheets help provide an explanation as to the derivation of this limit.

In NUREG-1391, the NRC states that 49% of the soluble uranium intake passes into the urine (this includes all pathways resulting from inhalation). However, using ICRP 66, only 28% of the soluble uranium goes into the urine (again this includes all pathways resulting from inhalation). Hence, the kidneys pass only about 57% of the uranium predicted by NUREG-1391 and, therefore, the intake to produce the same systemic burden of 21 mg is increased approximately by the inverse of 0.57, or 1.75.

Consequently, AREVA plans to use 75 mg as the threshold for permanent kidney damage, i.e. a high consequence event. (Note that this letter does not imply that AREVA agrees with 21 mg level, nor does it imply that AREVA accepts the calculations performed in NUREG-1391 as being correct.)

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To expedite timely reanalysis of affected portions of the ISA, AREVA will use the 75 mg value for high consequence criteria to the worker. If the NRC staff finds this criterion unacceptable, timely notification is requested.

Very truly yours,

A handwritten signature in black ink, appearing to read "Robert E. Link". The signature is stylized with a large, looped initial "R" and a distinct "L".

R. E. Link, Manager, Manager
Environmental, Health, Safety & Licensing

Justification for 75 mg Limit

From NUREG CR-4884, after 20,000 days, 0.487 is the fraction of the soluble uranium intake that has passed into the urine. McGuire uses 0.49 in NUREG-1391.

To determine what fraction should be applied using ICRP 66, AREVA turned to IMBA-URAN.

The following shows the dates used as inputs to IMBA corresponding to 20,000 days.

Beginning date: 1/1/1980
End date: 10/4/2034
No. of days: 20,000 (used as input to IMBA)

Assuming 100 mg was passed into the urine during the 20,000 days, 355 mg is the intake (output from IMBA). Thus 0.282 (100/355), rounded to 0.28, is the fraction of the intake that has passed into the urine.

The ratio of these two fractions is: $1.75 (0.49/0.28)$

In NUREG-1391, 21 mg in the body is listed as the threshold for permanent damage. This corresponds to an intake of 40 mg. ($21/0.49 = 42.9$)

Multiplying 42.9 mg. by 1.75 gives: 75 mg. Similarly, using ICRP 66, 21 mg corresponds to an intake of 75 mg. ($21/0.28 = 75$)

Summary: NUREG-1391 uses 21 mg as the threshold for permanent kidney damage. Under the old ICRP 30, the NRC calculated that an intake of 40 mg of soluble uranium would cause a systemic burden of 21 mg. Using 21 mg again as the threshold for permanent kidney damage, but using the new ICRP 66 model, an intake of approximately 75 mg of soluble uranium would be required.



IMBA-URAN Framatome ANP Edition



Exposure

Uranium Isotope

U-mix

Edit

Intake Type

Inhalation

Acute Chronic

Start Date: 01/01/80

Edit Absorption Parameters

Edit Aerosol Characteristics

Measurement

Measurement Type

Urinary Excretion

Units

Bq

pCi

mg

µg

Data Entry Mode

Enter Value from Screen

Data Stored in File

Measurement Date

10/04/2034

Measurement Value

100 mg

Collection Period

20000 d

Calculations

Estimate Intake

3.55E+02 mg

Calculate Dose

Most exposed organ

mSv

Committed Equivalent Dose

mSv

Other Organs

Committed Effective Dose

mSv

Calculate Kidney Concentration

Start Date

End Date

Interval

d

Exit

