March 8, 1995

MEMORANDUM FOR: James M. Taylor
Executive Director for Operations

FROM: John C. Hoyle, Secretary

SUBJECT: DOES AM-241 QUALIFY AS A "SIGNIFICANT CONTAMINANT" FOR PURPOSES OF 10 CFR §70.22(a)(4) AND REGULATORY GUIDE 10.3? (SECY-95-020)

In a matter arising out of its consideration of CLI-95-1 (February 28, 1995), the Commission has agreed that the staff should reexamine the circumstances under which Am-241 should be listed as a trace contaminant in a materials license application (or amendment application).

Currently, section 4.3 of the Commission's Regulatory Guide 10.3 provides that trace contaminants should be listed only if they are "significant contaminants." The Regulatory Guide goes on to state that "major dose-contributing contaminants present or expected to build up are of particular interest." This test may circumscribe too narrowly the circumstances under which Am-241 should be listed in an application (such as those of the University of Missouri) involving Pu-239 and/or Pu-240 as the principal isotope(s). For the reasons described below, Am-241's total equivalent activity (if sufficiently large) makes possible an accurate determination of the total health hazard or dose contribution of the plutonium with which the Am-241 is physically associated. The availability of such a determination may itself be sufficient reason to require Am-241 to be listed in a license application.

The timely measurement of Am-241 inside the human body (e.g., lung counting) is much more accurate than the timely measurement of plutonium. See Department of Energy, Health Physics Manual of Good Practices for Plutonium Facilities at page 4.49 (May 1988). More specifically, plutonium in the lung can be directly detected at minimum levels in the tens of nanocuries, while Am-241 can be directly detected at a far smaller minimum level of 0.1 nanocurie. Id. This disparity in the accuracy with which Am-241 and plutonium are measured is due to the following facts. The 60

KeV gamma ray emitted by Am-241 is easily strong enough to escape the human body. In addition, the rate of emission of the Am-241's 60 KeV gamma ray is sufficiently high to allow it to be measured with considerable precision. By contrast, the rates with which Pu-239 and its daughters emit their higher-energy x-rays or gamma rays are simply too low to allow measurement of Pu-239 in the body with any degree of precision. Because a direct measurement of plutonium requires an intake so much larger than the intake required for a direct measurement of Am-241, the latter measurement is often used to determine indirectly the plutonium dose in situations where the Am-241 is mixed with plutonium and where the Am-241/Pu ratio is known.

For example, with an Am-241/Pu ratio of 1/15 (a ratio pursuant to which the measurement of one nanocurie of Am-241 would indicate the presence of 15 nanocuries of plutonium), the detection level for this indirect method is only about 2 nanocuries of plutonium in the lung (as compared with at least 10 nanocuries needed for direct measurement). Id. Because Am-241, Pu-239 and Pu-240 all have the same ALI value of .006 microcurie[1] and therefore have an equally-hazardous dose contribution on a per-unit basis, an Am-241/Pu ratio of 1/15 would yield an internal dose contribution for Am-241 of 6.3 percent.[2]

It may be that, at or above some threshold level, Am-241's total equivalent activity is information critical to an accurate determination of the total health hazard or dose contribution of plutonium, and that the importance of such information may well be itself sufficient reason to require Am-241 to be listed as a

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[1] ALI is the derived permissible limit for the amount of radioactive material taken into the body of an adult worker by inhalation or ingestion in a year. The ALI can be found in Table 1 of Federal Guidance Report No. 11, Limiting Values of Radionuclide Intake and Dose Conversion Factors For Inhalation, Submersion, and Ingestion, EPA-520/1-88-020, at 31 et seq. (EPA, Sept. 1988).

[2] $$\frac{\text{Am-241}}{(\text{Pu-239} + \text{Pu-240} + \text{Am-241})} = \frac{1}{15 + 1} = \frac{1}{16} = 6.3\%$$

For simplicity, the small additional equivalent dose contribution of Pu-241 has been ignored. For instance, in the University of Missouri's plutonium sample, the dose from Pu-241 comprises only about 3.3 percent (3% ÷ [100% - 8.7%]) of the total equivalent dose attributable to the sample's plutonium (an insignificant amount when compared to the error of the total plutonium dose) and is too small to affect the result of the above calculation in any meaningful way.

"major dose-contributing contaminant" or "significant contaminant."

The staff should review this issue and advise the Commission regarding the appropriate activity level to recommend as that threshold and any changes they would make to the regulatory guidance.

(EDO) (SECY Suspense: 6/1/95)

cc: The Chairman
Commissioner Rogers
Commissioner de Planque
OGC
OCAA
OIG
PDR - Advance
DCS - OP1-24