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May 1, 1996

Director of Nuclear Reactor Regulation
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U. S. Nuclear Regulatory Commission
Washington, DC 20555

REFERENCE: Docket 50-186
University of Missouri Research Reactor
License R-103

SUBJECT: Responses to Request for Additional Information dated April 2, 1996

The University of Missouri Research Reactor (MURR) provides the following responses to the Nuclear Regulatory Commission letter of April 2, 1996, requesting additional information and clarification to evaluate the Emergency Plan revisions submitted by MURR on December 20, 1995.

The two requests for information and our responses are attached. If you have any questions concerning our responses, please contact me at (573) 882-5203 or Charlie McKibben at (573) 882-5204.

Sincerely,

Walt A. Meyer Jr.
Reactor Manager

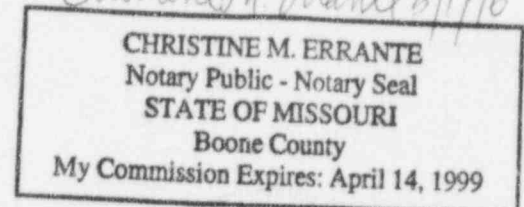
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xc: Mr. Alexander Adams, Jr.
Sr. Project Manager, NRR/PDNP

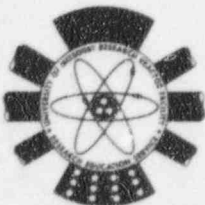
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ENDORSEMENT:
Reviewed and Approved

J. Charles McKibben
Associate Director



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Information Request #1:

1. Demonstrate that the EAL in the revised Emergency Plan meets the intent of the Commission.

Response:

In our letter of December 20, 1995, regarding notification of changes to the MURR Emergency Plan, we submitted the following Emergency Action Level (EAL) for the Site Area Emergency classification involving TRUMP-S materials:

"Fire in which more than 3 grams of TRUMP-S materials (americium, neptunium, plutonium) are involved."

The following paragraphs will demonstrate that this EAL meets the intent of the Commission order to clarify that "either a prolonged fire or explosion within the facility that can result in a release of radioactivity that could cause exposures of the public or staff approaching 1 rem whole body " or a "significant release possibly approaching EPA PAG levels" of such materials would constitute a Site Area Emergency (CLI-95-01 as modified by CLI-95-08).

The EAL was developed using the rationale described in NUREG-0849, Standard Review Plan for Review and Evaluation of Emergency Plans for Research and Test Reactors (p. 11). This reference indicates that EALs should be based on actual or potential radiological exposures and should describe specific instrument readings, observations, or judgements that will be used to initiate emergency measures. The technical basis for the EAL, the projected exposure at the nearest site boundary for a fire involving 3 grams of americium-241, is described in the response to information request #2.

The EAL describes the specific observation and judgment that is required to classify an event involving TRUMP-S materials as a Site Area Emergency, specifically if more than 3 grams of TRUMP-S materials are involved in a fire.

The MURR materials license which controls the TRUMP-S experiment requires a very strict inventory control of the TRUMP-S materials. The locations of these materials in inventoriable quantities is limited to the Alpha Laboratory, storage in the fuel vault, or infrequently in transit between these two material balance areas. The mass of TRUMP-S materials at each location is the most readily available information one could access in the event of a fire to determine a potential source term for projected radiological exposures.

If more than 3 grams of TRUMP-S materials were involved in a fire a Site Area Emergency would be initiated based on the potential projected exposure its dispersal could present at the site boundary. If less than 3 grams of TRUMP-S materials were involved in a fire an Alert classification would be initiated. If no TRUMP-S materials were involved in a fire, the appropriate emergency classification

would be determined by other EAL's. The Site Area Emergency EAL is consistent with the Commission's statement in CLI-95-08, p. 5: "Site area emergencies are declared on the basis of predictive judgments based on site conditions."

NUREG-1140, Regulatory Analysis on Emergency Preparedness for Fuel Cycle and Other Radioactive Materials Licensees, places emphasis on quick decisions and prompt action in materials license accident release scenarios. For this reason, the descriptive cause of the Site Area Emergency initiating event was shortened to "fire involving more than 3 grams of TRUMP-S materials" so that any judgment regarding what is or is not a "prolonged fire" would not reduce the ability to quickly initiate protective actions.

This phrase regarding cause of the emergency is intended to be a direct and shorthand version of the "prolonged fire or explosion" phrase much as the Commission intended at page 4 of CLI-95-08. The licensed staff who are trained to implement the MURR Emergency Plan recognize that the term "fire" would include "prolonged fire or explosion."

Information Request #2

2. Provide the technical basis or the analysis to show that 3 grams of TRUMP-S materials dispersed in a fire will result in a exposure of 1 rem whole body or approaching EPA PAG levels.

Response:

In CLI-95-11, paragraph 2, the Commission states "the potential for significant exposures at the site boundary is what triggers a Site Area Emergency." The technical evaluation that follows employs the Commission's computational methodology of the maximum expected off-site inhalation dose level [CLI-95-01, p. 121, footnote 125] and uses the worst case radionuclide (Am-241) as the source of the release. The calculation demonstrates that more than 3 grams of Am-241 have to be dispersed from a fire to approach 1 rem whole body exposure at the nearest site boundary. The "nearest site boundary" is defined in the MURR Emergency Plan [p. 22] as "the site boundary east-southeast of the MURR exhaust stack that represents the shortest distance between the stack and any site boundary for emergency planning purposes (approximately 400 meters).

Computation of the Maximum Expected Off-Site Inhalation Dose Level
from a fire involving 3 grams of Am-241

The fundamental equations from CLI-95-01, p. 121, footnote 125 are:

$$\text{Inhalation Dose } (D(r)) = (DCF) \cdot (B) \cdot (\chi/Q) \cdot (Q)$$

$$\text{Release Quantity } (Q) = (Q_{\text{Total}}) \cdot (RF)$$

These are combined to yield the following expression of dose rate:

$$D(r) = (DCF) \cdot (B) \cdot (\chi/Q) \cdot (Q_{\text{Total}}) \cdot (RF)$$

$$D(r) = (530 \text{ rem}/\mu\text{Ci}) (2.66 \times 10^{-4} \text{ m}^3/\text{sec}) (5.8 \times 10^{-4} \text{ sec}/\text{m}^3) (10.29 \times 10^6 \mu\text{Ci}) (10^{-3})$$

$$D(r) = 0.84 \text{ rem at 400 meters}$$

The five factors on the right side of the equation are derived below and are appropriate to reflect the dose at 400 meters from a release of 3 grams of Am-241:

$$(DCF) = 530 \text{ rem}/\mu\text{Ci} \quad (\text{NUREG-1140 at 80, Table 13})$$

$$(B) = 2.66 \times 10^{-4} \text{ m}^3/\text{sec} \quad (\text{NUREG-1140 at 12})$$

$$(Q_{\text{Total}}) = 10.29 \text{ Ci or } 10.29 \times 10^6 \mu\text{Ci}$$

$$(RF) = 10^{-3} \quad (\text{NUREG-1140 at 80, Table 13})$$

$$(\chi/Q) = 5.8 \times 10^{-4} \text{ sec}/\text{m}^3 \text{ for } r = 400 \text{ m} \quad [\text{NUREG-1140 at 13 (for meteorology condition F, 1 m/sec, no buoyancy)}]$$