

October 5, 2021

U.S. Nuclear Regulatory Commission  
Attention: Document Control Desk  
Washington, DC 20555-0001

REFERENCE:     Docket No. 50-186  
                     University of Missouri-Columbia Research Reactor  
                     Renewed Facility Operating License No. R-103  
  
                     Docket No. 030-32695  
                     The Curators of the University of Missouri Research Reactor Center  
                     Broad Scope Materials License No. 24-00513-39

SUBJECT:        Written communication as required by 10 CFR 30.35(e)(2) regarding an update to the  
                     University of Missouri-Columbia Research Reactor decommissioning cost estimate for  
                     calendar year 2021

The attached document provides an adjustment to the University of Missouri-Columbia Research Reactor (MURR) decommissioning cost estimate for calendar year 2021, in accordance with 10 CFR 30.35(e)(2).

If you have any questions regarding this report, please contact Bruce A. Meffert, the facility Reactor Manager, at (573) 882-5118.

Sincerely,



J. David Robertson, PhD  
Reactor Facility Director

JDR/bam

Enclosure

cc:     MURR Document Control  
         Reactor Advisory Committee  
         Reactor Safety Subcommittee  
         Dr. Thomas E. Spencer, Vice Chancellor for Research & Economic Development  
         Craig Bassett, U.S. NRC  
         Geoffrey Wertz, U.S. NRC

## Adjustment to MURR Decommissioning Cost Estimate 2021

### **I. Introduction**

In a letter dated June 29, 1990, the University of Missouri provided the U.S. Nuclear Regulatory Commission (NRC) a report required by 10 CFR 50.33(k)(2) providing reasonable assurance that funds would be available to decommission the University of Missouri-Columbia Research Reactor (MURR). As required by 10 CFR 50.75(e)(2)(iv)<sup>1</sup>, a cost estimate for decommissioning was provided. 10 CFR 50.75(d) further specifies that the cost estimate be adjusted periodically over the life of the facility. For Renewed Facility Operating License No. R-103, MURR adjusts the decommissioning costs every five years. However, as per 10 CFR 30.35(e)(2), adjusting the decommissioning costs for byproduct material licenses is required every three years. MURR has a Broad Scope Material License (No. 24-00513-39). Therefore, MURR will adjust the cost of decommissioning the facility every three years.

On August 31, 2006, MURR submitted a request to the NRC to renew Amended Facility Operating License No. R-103. On July 10, 2009, the NRC submitted a request for additional information (RAI) and clarification regarding the renewal request in the form of four questions in regard to financial qualifications and decommissioning costs. By an attachment to a letter dated September 14, 2009, MURR provided the NRC with a Statement of Intent (SOI) as the method to provide decommissioning funding assurance, as provided for by 10 CFR 50.75(e)(1)(iv). By letter dated February 11, 2013, the NRC requested updated financial information in the form of four questions because the information provided by the September 14, 2009, response had become outdated. By an attachment to a letter dated March 12, 2013, MURR provided the NRC with an updated SOI. By letter dated February 8, 2016, the NRC requested an updated response to those four questions because the information provided by the letter dated March 12, 2013, had become outdated. By an attachment to a letter dated March 29, 2016, MURR provided the NRC with an SOI and answered the four questions in a letter dated April 8, 2016. On January 4, 2017, MURR was issued Renewed Facility Operating License No. R-103 by the NRC.

The following is a chronological history of when the decommissioning costs were updated, the final cost estimate, and the reason for the update.

<u>Year</u>	<u>Cost Estimate</u>	<u>Reason for Updated Estimate</u>
2021	\$61.02 Million	Material License 10 CFR 30.35(e)(2)
2018	\$58.31 Million	Material License 10 CFR 30.35(e)(2)
2016	\$58.41 Million	Relicensing RAI dated April 8, 2016
2015	\$58.99 Million	Material License 10 CFR 30.35(e)(2)
2013	\$58.90 Million	Relicensing RAI dated February 11, 2013
2012	\$54.70 Million	Material License 10 CFR 30.35(e)(2)
2009	\$47.30 Million	Relicensing RAI dated July 10, 2009
2005	\$39.95 Million	Reactor License 10 CFR 50.33(k)(2)
2000	\$34.10 Million	Reactor License 10 CFR 50.33(k)(2)
1995	\$11.80 Million	Reactor License 10 CFR 50.33(k)(2)
1990	\$9.00 Million	Reactor License 10 CFR 50.33(k)(2)

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<sup>1</sup> The current regulation is 10 CFR 50.75(e)(1)(iv).

## Adjustment to MURR Decommissioning Cost Estimate 2021

### **II. Adjustment Factor Provided in 10 CFR 50.75(c)(2)**

The adjustment factor was designed for updating reference PWR and BWR decommissioning estimates, but serves as a convenient method to adjust estimated costs over time. The variables are relevant to research and test reactor decommissioning estimates, although the coefficients may vary slightly. Typically, an average of PWR and BWR cost is used.

Decommissioning costs are divided into three general areas per 10 CFR 50.75(c)(2) that tend to escalate similarly: (1) labor, materials, and services; (2) energy and waste transportation; and (3) radioactive waste burial/disposition. A relatively simple equation is used to update the estimate of cost, given a cost estimate in base-year dollars (1986 dollars), and the fractional escalation of these three categories of cost over the time period of interest.

The equation is:

$$\text{Estimated Cost (2021)} = [\text{1986 \$ Cost}] * [A L_x + B E_x + C B_x]$$

Where,

Estimated Cost (2021) = estimated decommissioning costs in 2021 dollars,

[1986 \$ Cost] = estimated decommissioning costs in 1986 dollars,

A = fraction of the [1986 \$ Cost] attributable to labor, materials, and services (0.65)

B = fraction of the [1986 \$ Cost] attributable to energy and transportation (0.13)

C = fraction of the [1986 \$ Cost] attributable to waste burial (0.22)

$L_x$  = labor, materials, and services cost adjustment, January 1986 to June 2021

$E_x$  = energy and waste transportation cost adjustments, January 1986 to July 2021

$B_x$  = LLW burial/disposition cost adjustment, January 1986 to December 2020

When the coefficients in the adjustment factor of 10 CFR 50.75(c)(2) are established as A = 0.65, B = 0.13, and C = 0.22, the escalation formula becomes:

$$\text{Estimated Cost (2021)} = [\text{1986 \$ Cost}] * [0.65 L_x + 0.13 E_x + 0.22 B_x]$$

## Adjustment to MURR Decommissioning Cost Estimate 2021

### **III. Determination of $L_x$ , $E_x$ , and $B_x$**

These ratios are determined using the information supplied by NUREG-1307, "Report on Waste Burial Changes," Rev. 18, and by the U. S. Department of Labor – Bureau of Labor Statistics (BLS) data.

#### **A. Labor Adjustment Factor**

The Employment Cost Index (ECI) is taken from Table 6 of the current BLS data entitled "Employment Cost Index for total compensation, for private industry workers, by bargaining status, census region, census divisions, and area." The ECI is taken for the West North Central Region. The Base  $L_x$  is taken from Table 3-2, "Regional Factors for Labor Cost Adjustment," in NUREG-1307 referenced above.

$$\begin{aligned} L_x &= [(ECI, \text{June } 2021) * (\text{Base } L_x)] / 100 \\ &= [(145.8) * (2.08)] / 100 \\ &= 3.03 \end{aligned}$$

#### **B. Energy Adjustment Factor**

The adjustment factor for energy,  $E_x$ , is a weighted average of two components, namely, industrial electrical power,  $P_x$ , and light fuel oil,  $F_x$ .

For the reference PWR:  $E_x(\text{PWR}) = 0.58 P_x + 0.42 F_x$

For the reference BWR:  $E_x(\text{BWR}) = 0.54 P_x + 0.46 F_x$

$P_x$  and  $F_x$  are the ratios of the current Producer Price Indexes (PPI) divided by the corresponding indexes for January 1986.

$$\begin{aligned} P_x &= 263.3 (\text{July } 2021 \text{ value for code wpu0543}) / 114.2 (\text{January } 1986 \text{ value for code wpu0543}) \\ &= 2.31 \end{aligned}$$

$$\begin{aligned} F_x &= 304.5 (\text{July } 2021 \text{ value for code wpu0573}) / 82.0 (\text{January } 1986 \text{ value for code wpu0573}) \\ &= 3.71 \end{aligned}$$

Therefore:

$E_x(\text{PWR})$	$E_x(\text{BWR})$
$= (0.58 * 2.31) + (0.42 * 3.71)$	$= (0.54 * 2.31) + (0.46 * 3.71)$
$= 2.90$	$= 2.95$

$E_x$  for MURR is calculated as an average of  $E_x(\text{PWR})$  and  $E_x(\text{BWR})$ , therefore:

$$\begin{aligned} E_x(\text{average}) &= (2.90 + 2.95) / 2 \\ &= 2.93 \end{aligned}$$

## Adjustment to MURR Decommissioning Cost Estimate 2021

### C. Waste Burial Adjustment Factor

The adjustment factor for waste burial/disposition,  $B_x$ , is taken directly from data on the appropriate LLW burial location as given in Table 2-1, “Values of  $B_x$  as a Function of LLW Burial Site, Waste Vendor, and Year<sup>(a)</sup>,” in NUREG-1307 referenced above. For facilities that have no disposal site available for LLW, the NUREG provides  $B_x$  values in the last column of Table 2-1.

$$B_x(\text{PWR}) = 12.793$$

$$B_x(\text{BWR}) = 12.837$$

$B_x$  for MURR is calculated as an average of  $B_x(\text{PWR})$  and  $B_x(\text{BWR})$ , therefore:

$$\begin{aligned} B_x(\text{average}) &= (12.793 + 12.837) / 2 \\ &= 12.82 \end{aligned}$$

## **IV. Adjusted Decommissioning Cost Estimate**

Estimated Cost (in 2021 \$)

$$\begin{aligned} &= [1986 \$ \text{ Cost}] * [A L_x + B E_x + C B_x] \\ &= [\$11.8 \text{ Million}] * [(0.65 * 3.03) + (0.13 * 2.93) + (0.22 * 12.82)] \\ &= [\$11.8 \text{ Million}] * [5.171] \\ &= \$61.02 \text{ Million} \end{aligned}$$

The current decommission cost estimate for the MURR is \$61.02 million in 2021 dollars.