



UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

March 30, 2016

Mr. Robert Compernelle
President, FMRI
FMRI, Inc.
Number 10 Tantalum Place
Muskogee, OK 74403

SUBJECT: NRC STAFF EVALUATION OF FMRI'S SUBMISSIONS UNDER 5A AND 5E OF
FORBEARANCE AGREEMENT DATED AUGUST 17, 2015

Dear Mr. Compernelle:

On December 14, 2015, FMRI sent its Derived Concentration Guideline Level ("DCGL") submission pursuant to Condition 5A of the Forbearance Agreement dated August 17, 2015 ("FA"). The NRC staff assessed the submission, found it unacceptable, and responded via letter dated January 19, 2016 (Agencywide Documents Access and Management System ("ADAMS") Accession No. ML16013A020). FMRI then submitted a response on February 3, 2016. The NRC staff have again assessed the response and found it unacceptable as detailed in this letter.

In addition, on February 16, 2016, FMRI sent a submission pursuant to Condition 5E of the FA. The NRC staff have also assessed that submission and found it to be unacceptable. That assessment is also detailed in this letter.

NRC Assessment of Condition 5A response dated February 3, 2016

Condition 5A of the FA states:

"FMRI shall submit to the NRC by December 31, 2015, revised Derived Concentration Guideline Level ("DCGL") values for the Muskogee site. The revised values shall address deficiencies identified in the NRC's Safety Evaluation Report ("SER") on the July 24, 2003 Decommissioning Plan (Agencywide Documents Access and Management System ("ADAMS") Accession No. ML033250083). If FMRI has not reached agreement with the NRC on the DCGLs by April 15, 2016, the NRC will determine the final DCGLs and amend FMRI's license accordingly."

Contrary to the above condition, which requires FMRI to provide revised DCGLs that address deficiencies identified by the NRC in the 2003 SER, FMRI did not acceptably address the deficiencies in its December 14, 2015, submission. The 2003 NRC SER indicated that FMRI should revise DCGLs for both soils & sediments and buildings & components to account for groundwater pathways. For soils and sediments, FMRI did not revise the DCGLs, but, instead, FMRI provided unacceptable justification for continuing to exclude groundwater pathways. The NRC explained in the letter dated January 19, 2016, why the justification submitted by FMRI was unacceptable. For building and component surfaces, FMRI proposed revised DCGLs but,

again, did not address groundwater pathways. The NRC staff responded to this effect via the letter dated January 19, 2016.

On February 3, 2016, FMRI provided a response regarding Condition 5A. The February 3, 2016, FMRI response ("FMRI response") listed four items, quoted below:

1. FMRI has agreed to run RESRAD with drinking water as an exposure pathway for soils and sediments and has attached the revised DCGL results to this letter.
2. FMRI will use RESRAD BUILD for DCGL's for building surfaces only. Attached to this letter is page I-I of the User's Manual for RESRAD BUILD Version 3. The Manual explains that there are seven exposure pathways that are considered in the RESRAD BUILD code, none of which are groundwater. As such, FMRI's analysis results will not change the existing DCGL's in the DP for building surfaces.
3. As requested on page 3 of the Assessment and the 2003 SER, FMRI agrees to use Regulatory Guide 1.86 to separately assess for building components (i.e. equipment and piping).
4. FMRI will use the sum of the fractions rule for all applicable pathway's to assure compliance with IO CFR 20.1402. See also license conditions 35 and 36.

Items 1 and 2:

As discussed in its January 16, 2016, letter, the NRC staff determined that FMRI should account for the potential dose from contaminated groundwater in the DCGLs for soils & sediments and building surfaces & equipment (i.e., items (1) and (2) above). In its response, FMRI addressed the soil and building DCGLs differently.

For soil DCGLs, FMRI agreed to account for the projected dose from using contaminated groundwater. The FMRI response included RESRAD (Version 6.21) model output that included the drinking water pathway. However, FMRI's model does not adequately account for potential doses from the drinking water pathway. The NRC staff has two technical concerns with the FMRI model:

1. RESRAD projects dose based only on contamination projected to leach from the soil and does not account for the existing groundwater contamination; and
2. Certain parameter values, which were appropriate when the drinking water pathway was excluded, do not appear to be appropriate for a scenario in which a drinking water pathway is included.

Regarding the first concern, RESRAD calculates the projected dose based only on the contamination that is calculated to be transported from the contaminated soil into the groundwater. As a result, the FMRI model projects zero dose from the drinking water pathway for 1000 years, even though Table 4-24 of the NRC 2003 SER shows significant groundwater contamination in several monitoring wells.

Although the model runs submitted by FMRI do not account for the existing groundwater contamination, relatively simple methods to account for the residual groundwater contamination

may be sufficient. One simple method is to use hand calculations to convert residual groundwater concentrations, left after groundwater remediation is considered complete, into a projected dose by considering ingestion of the groundwater. Table 5.2-2 of the NRC 2003 SER, reproduced here as Table 1, provides radionuclide groundwater concentrations that would produce doses of 25 mrem/yr for each radionuclide (i.e., if each radionuclide were the only one in the groundwater) based on the assumption of drinking 445 liters of well water per year.

Table 1 (reproduced from NRC (2003) Table 5.2-2) Groundwater concentrations that each result in a projected dose of 25 mrem/y from the drinking water pathway

Radionuclide	Ingestion Dose Conversion Factor (mrem/pCi)	Concentration (pCi/L)
Ac227+D	1.48×10^{-2}	3.8
Pa-231	1.06×10^{-2}	5.3
Pb-210+D	7.27×10^{-3}	7.7
Ra-226+D	1.33×10^{-3}	42.4
Th-230	5.48×10^{-4}	104.2
U-234	2.83×10^{-4}	192.3
U-235+D	2.67×10^{-4}	208.3

Using a sum-of-fractions approach, the projected dose from the groundwater contamination that will remain after groundwater remediation is considered complete can be subtracted from the 25 mrem/yr limit when soil DCGLs are developed. For example, if the projected dose from ingesting groundwater is 10 mrem/yr, DCGLs for soils & sediments and for building surfaces & equipment could be based on limiting the projected dose from soils, sediments, building surfaces, and equipment to 15 mrem/yr. That is:

$$\begin{aligned} &(\text{projected dose from groundwater ingestion at groundwater concentrations after remediation}) + \\ &(\text{projected dose from exposure to soils \& sediments at DCGL}) + \\ &(\text{projected dose from exposure to building surface \& equipment at DCGL}) = 25 \text{ mrem/year} \end{aligned}$$

If FMRI demonstrates that the occupancy assumptions used to develop the DCGLs for soils & sediments and building surfaces & equipment would not allow one individual to receive the projected dose from both soils & sediments and building surfaces & equipment, FMRI may be able to justify not summing the DCGLs from soils & sediments and building surfaces & equipment. That is, based on occupancy assumptions, FMRI may be able to justify using the following equations:

$$\begin{aligned} &(\text{projected dose from groundwater ingestion at groundwater concentrations after remediation}) + \\ &(\text{projected dose from exposure to soils \& sediments at DCGL}) = 25 \text{ mrem/year} \end{aligned}$$

And

$$\begin{aligned} &(\text{projected dose from groundwater ingestion at groundwater concentrations after remediation}) + \\ &(\text{projected dose from exposure to building surface \& equipment at DCGL}) = 25 \text{ mrem/year.} \end{aligned}$$

Using the hand calculation described above is one possible method that could be used. It is not the only method available, and using this particular method is not required.

The second technical concern is that some parameter values were established to be conservative (i.e., expected to result in a higher projected dose than if using the true value of the parameter) for a scenario in which the drinking water pathway was excluded but do not appear to be appropriate for a scenario in which a drinking water pathway is included. For example, Table 5-10 of the 2003 FMRI Decommissioning Plan indicates that increasing the evapotranspiration coefficient (i.e., the fraction of precipitating water that evaporates or transpires from vegetation) increases the projected dose and that the maximum value was used in the DCGL derivation. While increasing the evapotranspiration coefficient may increase projected dose in a scenario without a drinking water pathway, it also limits projected leaching of contamination from soil to groundwater, thereby limiting the projected dose from groundwater pathways when they are active. Using the RESRAD inputs provided in the FMRI response, NRC staff found that changing the evapotranspiration coefficient from 0.99 to 0.97 caused more than a four order of magnitude increase (i.e., over 1,000,000 percent increase) in projected peak dose within 1000 years. Because of the sensitivity of the projected results to this parameter value when a drinking water pathway is included, additional support is needed to justify the choice of using 0.99 as the evapotranspiration coefficient instead of a lower value.

The evapotranspiration coefficient is one example of a parameter value that appeared to be conservative and appropriate when a drinking water pathway was not included but has not been shown to be appropriate when a drinking water pathway is included. The evapotranspiration coefficient may not be the only such parameter; therefore, other parameter values should be evaluated to determine whether they are still appropriate when a drinking water pathway is included.

Regarding DCGLs for building surfaces and equipment, the FMRI response states:

“The [RESRAD BUILD] Manual explains that there are seven exposure pathways that are considered in the RESRAD BUILD code, none of which are groundwater. As such, FMRI's analysis results will not change the existing DCGL's in the DP for building surfaces.”

The residual groundwater contamination levels left after the completion of groundwater remediation represent a potential source of exposure by ingestion and possibly other routes of intake. This potential source of exposure must be accounted for in the development of soil & sediment DCGLs and DCGLs for building surfaces and equipment. RESRAD's, and RESRAD BUILD's, limitation of not utilizing existing groundwater radionuclide concentrations as a source of projected dose does not change the need to account for that exposure pathway. The NRC does not require or endorse the use of a particular vendor or software to determine DCGLs. The limitations of any particular piece of modeling software do not affect FMRI's responsibility to account for relevant exposure pathways.

Furthermore, FMRI does not need to find one model that accounts for all of the potential exposure pathways. For example, as discussed above in the context of the soil & sediment DCGLs, FMRI may choose to allocate a fraction of the 25 mrem/y criterion between the 3 different media of concern for which DCGLs are being developed (e.g., 4 mrem/y for groundwater, 11 mrem/y for soils, and 10 mrem/y for buildings such that, in total, the sum is equal to 25 mrem/y). The DCGLs could then be developed for each medium, the site appropriately remediated, and the residual contamination survey data compared to the DCGLs consistent with MARSSIM. The NRC acknowledges that this is a simple method to facilitate

planning for remediation of the site but not the only method available. Regardless of the methods taken to evaluate the various pathways, 10 CFR 20.1402 establishes a criterion of 25 mrem/y potential dose to the average member of the critical group (as defined in 10 CFR 20.1003) from all applicable pathways as well as being ALARA.

Item 3:

As item 3, FMRI stated the following: “As requested on page 3 of the Assessment and the 2003 SER, FMRI agrees to use Regulatory Guide 1.86 to separately assess for building components (i.e. equipment and piping).” NRC understands this statement to mean FMRI will use Regulatory Guide 1.86 to assess removable building components for off-site release, as NRC requested, and finds this use adequate.

Item 4:

Regarding the final item addressed in its response, FMRI commits to using a sum-of-fractions approach for all appropriate exposure pathways. However, the remainder of the response does not support this position because of (1) technical concerns with the development of the soil DCGLs described in this letter and (2) FMRI’s decision not to account for contaminated drinking water in the DCGLs for building surfaces and equipment. Therefore, NRC staff finds the proposed DCGLs do not adequately consider the potential usage of site groundwater as required by Condition 5A of the FA.

NRC Staff Assessment of Condition 5E Submission Dated February 16, 2016

Condition 5E of the FA states:

“Within 6 months from the signature of the Forbearance Agreement, FMRI shall submit evidence to DOJ, NRC, and ODEQ of its efforts to solicit bids for establishment of a contract for the shipment and disposal of CaF material.”

Contrary to the above condition, which provides for FMRI’s submission of evidence of its efforts to solicit bids for establishment of a contract for the shipment and disposal of Calcium Fluoride (“CaF”) material, it was noted that the evidence submitted was dated April 2015, which is prior to the date that the Forbearance Agreement was signed. As such, the submission does not comply with Section 5E because it does not indicate any efforts made during the period of the FA. Also, the FA requires evidence of FMRI’s “efforts to solicit bids,” but there was no financial information or evidence of bids in the submission. FMRI’s submission appeared to be of no more substance than a sales presentation and did not demonstrate solicitation of bids or progress toward establishment of a contract. NRC responded to this effect via email on February 18, 2016.

Rather than provide information indicating evidence of its efforts to solicit bids during the Forbearance Agreement period, FMRI instead responded via email on February 22, 2016 that FMRI believed its submission, dated February 16, 2016, constitutes compliance in full with Condition 5E of the FA. The reasons given by FMRI were that:

“...there is nothing in Condition 5E that requires FMRI to (i) provide evidence of efforts to solicit bids post August 17, 2015 only or (ii) provide bids as opposed to evidence of

FMRI's efforts to solicit bids. The material sent to the NRC on February 16, 2016 is evidence of FMRI's efforts to solicit bids for the disposal of CaF material and, as such, qualifies under the express language of Condition 5E as compliance therewith.

FMRI believes that actual bids could not possibly be required under Condition 5E, as any bid would be subject to confidentiality between FMRI and the bidder, and FMRI could not provide confidential information to the NRC unless the NRC agreed to be bound by the same confidentiality requirements as FMRI.

Moreover, with respect to additional efforts by the FMRI to solicit bids for the disposal of CaF material, the NRC is fully aware of FMRI's efforts to find alternative and less expensive avenues for disposal of the CaF which matters were the subject of a telephone conference on December 4, 2015 among FMRI, Clean Harbors, the ODEQ and the NRC. These efforts have not been reduced to a writing that could be provided to the NRC, and, in any event, such writing would likely be confidential among the various parties."

Considering FMRI's response via email, NRC staff maintains that the submission of February 16, 2016, did not acceptably meet condition 5E of the FA. The conditions of the FA were established, primarily, to ensure progress towards remediation of the FMRI site. The December 4, 2015, meeting with ODEQ did not demonstrate progress towards remediation efforts for the site, and no other effort was shown during the period of the FA. Also, the NRC will withhold information from public disclosure that is "privileged or confidential" consistent with 10 CFR 2.390; therefore, non-compliance with Condition 5E because of its confidential nature is not acceptable. Although NRC staff has had multiple discussions with FMRI on this subject, staff is willing to have additional discussions, if necessary.

In accordance with 10 CFR 2.390 of the NRC's "Agency Rules of Practice and Procedure," a copy of this letter will be available electronically for public inspection in the NRC Public Document Room or from ADAMS. ADAMS is accessible from the NRC Web site at <http://www.nrc.gov/reading-rm/adams.html>.

R. Compernelle

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Please contact Mr. Greg Chapman if you have any questions concerning the above. He can be reached at (301) 415-8718 or via e-mail at Gregory.Chapman@nrc.gov.

Sincerely,

/RA/

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Recovery, and Waste Programs
Office of Nuclear Material Safety
and Safeguards

Docket No. 40-7580
License No. SMB-911

cc: Christina England, NRC/OGC
Pam Dizikes, Oklahoma Department of
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Please contact Mr. Greg Chapman if you have any questions concerning the above. He can be reached at (301) 415-8718 or via e-mail at Gregory.Chapman@nrc.gov.

Sincerely,

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