

BACKGROUND INFORMATION FOR LEVEL 2 CONSULTATION ON CUSHING REFINERY SITE

The Kerr-McGee, Cushing Site

The Kerr-McGee (KM), Cushing site, owned by KM Corporation and located in Cushing, Oklahoma, was used during 1962 through 1966 to process natural thorium and natural, depleted, and enriched uranium, under two Atomic Energy Commission licenses. The site was decommissioned and the licenses terminated in 1966. Beginning in April 1993, the site was licensed again to perform further decommissioning activities resulting from the past nuclear activities. The site consists of approximately 1.7 square kilometers (440 acres), and approximately 16 separate areas in various locations throughout the site were affected with elevated radionuclide concentrations through the intentional or accidental disposition of radioactive materials.

Soil Contamination

Because KM, Cushing's Decommissioning Plan (DP) was approved before the License Termination Rule (LTR) in 10 CFR Part 20, Subpart E, consistent with the grandfathering provision of the LTR, KM, Cushing is cleaning up in accordance with the concentration-based criteria in the U.S. Nuclear Regulatory Commission's (NRC)'s 1992 Site Decommissioning Management Plan Action Plan (57 FR 13389), rather than the current dose-based LTR criteria. The approved DP contains a concentration guideline level for thorium-232 (Th-232), depleted uranium (U), and enriched U in soil of: (a) 0.185 becquerels per gram (Bq/g) [5.0 picocuries per gram (pCi/g)]; (b) 1.3 Bq/g (35 pCi/g); and (c) 1.11 Bq/g (30 pCi/g), respectively. Natural Th was received at Cushing in purified form and has long reached secular equilibrium. Also, as a conservative measure to satisfy the concern that some U-238 may have come from enriched uranium, KM has used a concentration of 1.11 Bq/g (30 pCi/g) for total U. Therefore, KM has used the following equation to meet the above concentration limits for combined radionuclide concentrations:

$$\frac{7U^{238} + U^{235} + U^{234}}{30} + \frac{7Th^{232} + Th^{228}}{10} \leq 1$$

(The use of this equation results in lower concentrations than those cited in Environmental Protection Agency's Table 1, of the Memorandum of Understanding (MOU) of 0.185 Bq/g (5.0 pCi/g) for Th-232 and 47 milligram per kilogram for total U, for the resident scenario).

NRC notes that, in its experience, sites are often remediated well below the cleanup levels because of the nature of the cleanup process. For this reason, the site will not require a Level 2 consultation for soil contamination, because the levels of residual radioactivity remaining after remediation will be lower than the MOU trigger values. As stated earlier, NRC is currently reviewing the Final Status Survey Reports for the Cushing site and will verify that the residual radioactive concentrations at the site do not exceed the trigger values in the MOU.

Enclosure

Groundwater Contamination

The KM, Cushing DP, approved in August 1999, contained results of preliminary groundwater investigations conducted at the site, and a commitment to conduct a thorough groundwater analysis to support license termination. The KM "*Cushing Refinery Site Radiological Groundwater Assessment Report*" (GAR) was submitted to NRC in March 2003.¹ NRC requested additional information on the GAR on March 23, 2004.² KM submitted responses to this request to NRC on April 6, 2004,³ and supplemented the responses with additional information on May 24, 2004.⁴ NRC approved the GAR on May 27, 2004.

Based on the results of the groundwater investigations documented in the GAR, KM submitted a request to NRC on September 9, 2002, entitled, "*Alternate Concentration Limit (ACL) Derivation for Cushing*," to establish an ACL for total U in shallow groundwater in one sector of the Cushing site.⁵

NRC requested additional information on the ACL derivation document on September 3, 2003. KM submitted responses to NRC request, along with Revision 1 of the Derivation document, on December 31, 2003, and requested a license amendment for adding the ACL to the approved decommissioning criteria in NRC license for the Cushing site.⁶ NRC is in the process of adding the ACL for U in groundwater to the Cushing site's Special Nuclear Material (SNM) license (License No. SNM-1999) in a license amendment that responds to this request and other requests for amendments made by the licensee.

¹ *Kerr-McGee Cushing Refinery Site, Radiological Groundwater Assessment Report*, Revision 0 - March 2003, Docket No. 70-3073. The Radiological Groundwater Assessment Report is available in three volumes in NRC's electronic reading room at <http://www.nrc.gov/reading-rm.html> (ML031040373, ML031040378, and ML031050300).

² Letter; Widmayer, NRC to Lux, Kerr-McGee, *NRC Review of Sector 5 Final Status Survey Report and Radiological Groundwater Assessment Report for the Kerr-McGee Cushing Refinery Site*, March 23, 2004, is available in NRC's electronic reading room at <http://www.nrc.gov/reading-rm.html> (ML040790357).

³ Letter; Lux, Kerr-McGee to Widmayer, NRC, April 2, 2004, is available in NRC's electronic reading room at <http://www.nrc.gov/reading-rm.html> (ML041050290).

⁴ Memo; Keane, ENERCON, to Distribution, *Kerr-McGee Cushing Site - Groundwater Assessment Report*, May 24, 2004, is available in NRC's electronic reading room at <http://www.nrc.gov/reading-rm.html> (ML041480298).

⁵ *Technical Memorandum 02-04, Alternate Concentration Limit (ACL) Derivation for Cushing*, September 2002, is available in NRC's electronic reading room at <http://www.nrc.gov/reading-rm.html> (ML022610452).

⁶ Letter; Lux, Kerr-McGee to Widmayer, NRC, enclosing *Technical Memorandum 02-04, Alternate Concentration Limit (ACL) Derivation for Cushing*, Revision 1, December 2003, is available in NRC's electronic reading room at <http://www.nrc.gov/reading-rm.html> (ML051920109).

Approval of the ACL

The September 2002, "*Alternate Concentration Limit (ACL) Derivation for Cushing*," requested an ACL in groundwater of 40.7 Bq/Liters (L) (1100 pCi/L) for total U and .41 Bq/L (11.2 pCi/L) for total Th for the Cushing site, using the resident farmer scenario.

NRC's September 2003 request for additional information provided preliminary results of NRC staff calculations of the ACL, using input values provided by KM and its contractor, and suggested that KM further justify some of its parameter values, conduct a sensitivity analysis to determine the most sensitive parameters, and select appropriate site-specific parameter values, based on the results of the sensitivity analysis.

The December 2003 Revision 1 of "*Alternate Concentration Limit (ACL) Derivation for Cushing*," provides the results of the analysis conducted by KM, based on NRC's suggested improvements to parameter selection. Revision 1 requested an ACL in groundwater of 30.34 Bq/L (820 pCi/L) for total U [the request for an ACL for thorium was removed based on results of monitoring conducted subsequently to the preparation of Revision 0, which indicated that Th levels in the groundwater were all within the range of background measured at the site [.00074 Bq/L - .025 Bq/L (0.02 pCi/L - 0.67 pCi/L)], therefore, well below the maximum contaminant level (MCL) for Th of 5.0 pCi/L].

The staff reviewed Revision 1 of the ACL Derivation document and conducted verification dose analysis using the GENII code. The staff prepared a Safety Evaluation Report on May 13, 2004,⁷ approving the licensee's derivation of the 30.34 Bq/L (820 pCi/L) ACL for total U in groundwater at the Cushing site. The staff also prepared an Environmental Assessment (EA), to support the amendment to the license currently being prepared, adding the ACL to the Cushing site's license No. SNM-1999.⁸

Based on the EA, the staff has prepared a Finding of No Significant Impact (FONSI) in approving the license amendment to include the ACL for U in shallow groundwater at the Cushing site. A significant contributing factor to the FONSI is that the State of Oklahoma's Department of Environmental Quality (DEQ) found that the shallow groundwater at the Cushing site would not likely be a future residential or commercial source of drinking water because of low-yield of poor quality water and that the State of Oklahoma DEQ would consider it appropriate to establish water quality standards other than the MCLs for the shallow

⁷ *Safety Evaluation Report on Kerr-McGee's Alternate Concentration Limit (ACL) Derivation for Cushing; Technical Memorandum 02-04*, May 13, 2004, is available in NRC's electronic reading room at <http://www.nrc.gov/reading-rm.html> (ML051890261).

⁸ *Environmental Assessment Related to an Amendment of NRC License SNM-1999 for Alternate Concentration Limits for Groundwater at the Kerr-McGee Cushing Refinery Site, Cushing, OK*, January 4, 2005, is available in NRC's electronic reading room at <http://www.nrc.gov/reading-rm.html> (ML050040140).

groundwater at Cushing.⁹ Another significant factor in the FONSI is that monitoring of groundwater in the sector for which the ACL was proposed has shown that actual U concentrations in the shallow groundwater are well below the ACL and are trending downward.

⁹ Letter; Shults, Oklahoma Department of Environmental Quality, to Lux, Kerr-McGee, September 19, 1997, is available in NRC's electronic reading room at <http://www.nrc.gov/reading-rm.html> (ML041610458).