



Umetco Minerals Corporation

2754 COMPASS DRIVE, SUITE 280
GRAND JUNCTION, COLORADO 81506
970.245.3700

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Mr. Dominic Orlando, Senior Project Manager
Decommissioning and Uranium Licensing Directorate
Division of Waste Management and Environmental Protection
Office of Federal and State Materials and Environmental Management Programs
U.S. Nuclear Regulatory Commission
Mail Stop T-8F5
11545 Rockville Pike
Rockville, Maryland 20852

Reference: **Radioactive Materials License SUA-648; Docket No. 040-0299**
Subject: **Request for License Amendment to License Condition 35A – Appendix M**

Dear Mr. Orlando,

Per the telephone conversation with you today, Umetco Minerals Corporation (Umetco) has reviewed the submittal dated June 9, 2011, which requested modifications to Appendix M – Groundwater Monitoring Plan, for completeness. The attached October 2011 revision to Appendix M has been reviewed to ensure all references to semi-annual sampling have been deleted along with any reference to monitoring well PW4.

Also, as discussed, Umetco agrees to continue sampling and analyzing Iron Spring as described in Table M-1 of Appendix M as required by Umetco's license and amended license upon approval.

If you, or the staff, have any questions, please contact me at 970-256-8889 or by e-mail at gieckte@dow.com.

Regards,

Thomas E. Gieck
Remediation Leader

cc: Mark Moxley, WDEQ

11-047

Appendix M

Groundwater Monitoring Plan Gas Hills, Wyoming

Umetco Minerals Corporation
2754 Compass Drive, Suite 280
Grand Junction, Colorado 81506

March 2002
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* Sulfate and chloride target levels for non-POC model validation wells are provided in Attachment M-1, Tables 2 through 5.

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M-1	Monitoring Locations
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Also see Attachment M-1 Figures 1.a through 8.b.

Attachments

Attachment M-1	Target Level Derivation and Model Validation Approach for Chloride and Sulfate
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1.0 INTRODUCTION

This groundwater monitoring plan was developed in support of (revised) License Condition (LC) 35, which stipulates that Umetco implement a groundwater compliance monitoring program and identify appropriate actions to be taken if the Alternate Concentration Limits (ACLs) for groundwater are exceeded. In accordance with LC 35, this appendix identifies the groundwater monitoring locations for each flow regime, presents the associated monitoring plan, and describes how Umetco will define and address potential exceedances of ACLs and/or target levels established for non-licensed indicator constituents.

2.0 MONITORING APPROACH

Three types of monitoring wells are included in the Gas Hills site groundwater compliance monitoring program:

- (1) the existing point of compliance (POC) wells;
- (2) non-POC wells for the purposes of tracking any future (unexpected) downgradient and/or vertical contaminant migration; and
- (3) a subset of the downgradient non-POC wells defined above, for the purposes of validating the site geochemical and groundwater flow model and to ensure that sulfate and chloride—non-licensed constituents regulated by the Wyoming Department of Environmental Quality (WDEQ)—do not exceed model predictions and/or WDEQ standards.

Table M-1 defines the POC and non-POC monitoring wells and summarizes the corresponding monitoring approach, including the sampling frequency and the specific analytes to be monitored. Groundwater monitoring locations are shown on Figure M-1 for both the Western and Southwestern flow regimes.

2.1 Point of Compliance Wells

The four existing POC wells—Western Flow Regime (WFR) wells MW1 and MW21A and Southwestern Flow Regime (SWFR) wells GW7 and GW8—will be sampled annually with analysis for ACL constituents. In addition, MW21A and GW7—located at or near the leading edge of the plume in their respective flow regimes—will be sampled annually with analysis for sulfate and chloride. GW7 has consistently had the highest observed concentrations of several licensed constituents, and is considered a “hot spot” within the SWFR contaminant plume.

2.2 Non-POC Wells

Non-POC monitoring wells were selected to provide early detection of any future downgradient or vertical contaminant migration, and/or to verify the groundwater flow and geochemical modeling results presented in the ACL application. These wells are identified in Table M-1 and shown on Figure M-1. Rationales supporting their selection are documented in Table M-2.

Table M-1 Gas Hills Site Groundwater Compliance Monitoring Wells

Well Type	Western Flow Regime Wells ¹	Southwestern Flow Regime Wells ²	Monitoring Approach ³
Point of Compliance (POC) Wells	MW1 MW21A*	GW7* GW8	Wells to be sampled annually for ACL constituents. Sampling to be conducted every June until license termination, with results to be submitted to the NRC by September 30 of the same year. *Asterisked wells—MW21A and GW7—to be sampled annually for sulfate and chloride.
Non-POC Wells	MWI64 MW70A MW25 MW71B** MW28** MW77 Iron Spring	MW72** MW82**	Sampling of these non-POC wells will be conducted annually with analyses for sulfate, chloride, and uranium-natural. Except for chloride and sulfate monitoring at the four model validation wells (explained below), <i>this sampling will be conducted for information and tracking purposes only</i> —i.e., results will not be assessed for exceedances. **Results for asterisked wells—MW71B, MW28, MW72, and MW82—will be used to verify model results (see below).
Model Validation Wells <i>(subset of above non-POC wells)</i>	MW71B MW28	MW72 MW82	Annual sampling for chloride and sulfate as described above. Results will be compared with the target levels derived for the applicable timeframe. See Section 3.0 and Attachment M-1 Tables 2 through 5.

¹ Alternate Concentration Limits (ACLs) established for the Western Flow Regime POC wells MW1 and MW21A are as follows: Arsenic = 1.8 mg/l; Beryllium = 1.64 mg/l; Lead-210 = 35.4 pCi/l; Nickel = 13.0 mg/l; combined Radium-226 and -228 = 250 pCi/l; Selenium = 0.161 mg/l; Thorium-230 = 57.4 pCi/l; and Uranium-natural = 11.9 mg/l. Action levels for chloride and sulfate are listed in Table M-3.

² ACLs established for the Southwestern Flow Regime POC wells GW7 and GW8 are: Arsenic = 1.36 mg/l; Beryllium = 1.70 mg/l; Lead-210 = 189 pCi/l*; Nickel = 9.34 mg/l; combined Radium-226 and -228 = 353 pCi/l; Selenium = 0.53 mg/l; Thorium-230 = 44.8 pCi/l; and Uranium-natural = 34.1 mg/l. Action levels for chloride and sulfate are listed in Table M-3. *The Pb-210 ACL of 189 pCi/l reflects the findings presented in the June 2005 report entitled *Determination of Lead-210 for the Southwestern Flow Regime* was approved by the Nuclear Regulatory Commission in the Finding of No Significant Impact dated January 20, 2006 and subsequent License Amendment No. 56 dated March 24, 2006.

³ Results of monitoring will be provided in the Groundwater Monitoring Review as required by License SUA-648.

Table M-2 Rationales Supporting Selection of Non-POC Monitoring Wells

WESTERN FLOW REGIME	
Monitoring Well	Basis for Selection
MWI64	This well is located at the downgradient edge of the Above-Grade Tailings Impoundment (AGTI) and exhibits some of the highest observed values for beryllium, nickel, lead-210, radium 226+228, uranium-natural, gross alpha, chloride and sulfate. This well is within the “hot spot” area of the plume.
MW70A	This location is approximately 1,700 feet to the northwest of the restricted area. This well is screened in the upper portion of the Western Flow Regime and will monitor radial flow from the AGTI.
MW25	Water quality data and isoconcentration plots indicate this well, located approximately 1,500 feet hydraulically downgradient of the AGTI, would be appropriately located to monitor the leading edge of the plume.
MW71B**	This well is approximately 2,500 feet downgradient of the AGTI. It is screened in the lower portion of the Western Flow Regime and will indicate potential vertical migration.
MW28**	This well is located 2,500 feet hydraulically downgradient of the AGTI. Water quality data and isoconcentration plots indicate that there has been no impact from site-derived constituents. This location is a few hundred feet in advance of the groundwater plume and will provide the earliest indication of migration.
MW77	This location is near the proposed land transfer boundary, 4,000 feet hydraulically downgradient of the AGTI, and is representative of water quality at the Point of Exposure (POE). Modeling indicates that site-derived constituents will reach this location in 70 to 80 years but will not degrade water quality to less than its current Class III status.
Iron Spring	This spring, approximately 10,000 feet from the AGTI, is the closest discharge point for groundwater migrating from the site. Groundwater modeling indicates no significant impacts to water quality resulting from site-derived constituents.
SOUTHWESTERN FLOW REGIME	
Monitoring Well	Basis for Selection
MW72**	Water quality data and isoconcentration plots indicate this well, located 1,000 feet southwest of the A-9 Repository, may be impacted from site derived constituents and is located near the downgradient edge of the groundwater plume migrating from the site.
MW82**	This well is the furthest downgradient location from the A-9 repository (approximately 1,300 feet). The well location was selected based on its position along the modeled axis of the plume and also because it is upgradient of Power Resources, Inc.'s proposed Mine Unit 5.

Note: All wells listed above will be sampled annually for analysis of sulfate, chloride, and uranium-natural. Sulfate and chloride results for asterisked (**) wells—MW71B, MW28, MW72, and MW82—will also be used to verify model results.

The non-POC monitoring locations listed in Table M-2 were selected on the basis of one or more of the following criteria, with input from the U.S. Nuclear Regulatory Commission (NRC):

- location within the plume and in “hot spot” locations;
- location proximal to extraction wells;
- location at downgradient edge of the plume;
- downgradient of site impacts; and/or
- discharge points for groundwater (e.g., springs).

Sampling of non-POC wells will be conducted annually with analyses for sulfate, chloride, and uranium-natural as indicated in Table M-1.

3.0 MODEL VALIDATION COMPONENT OF COMPLIANCE MONITORING: CHLORIDE AND SULFATE

A subset of the non-POC wells defined above—WFR wells MW71B and MW28 and SWFR wells MW72 and MW82—will be compared with target levels established for chloride and sulfate (see Attachment M-1). Although chloride and sulfate are not licensed constituents, they do have groundwater protection standards set by the WDEQ. More importantly, these constituents are minimally attenuated and therefore should provide the earliest indication of site-derived contaminant migration along groundwater flowpaths. As such, target levels were derived for the purposes of validating the sulfate and chloride model simulations. The monitoring approach is summarized in Table M-1, and detailed supporting information is provided in Attachment M-1. Target levels established for individual model validation wells are documented in Attachment M-1, Tables 2 through 5.

4.0 EXCEEDANCE IDENTIFICATION AND VERIFICATION RESAMPLING

The monitoring approach described above and in Table M-1 was developed to ensure that the groundwater ACLs are met, as well as to provide early detection of downgradient or vertical migration of site contaminants. As such, a mechanism for identifying exceedances and implementing appropriate responses to those exceedances, must be identified.

4.1 General Approach to Identifying Exceedances

In identifying exceedances, the overall intent is to allow early detection of potential ACL or target level exceedances, while minimizing the probability of false positive results—e.g., exceedances attributable to laboratory error or transient anomalous increases. Prediction limits are already built into both the ACLs and the target levels established for non-ACL (indicator) constituents. Therefore, comparison of the single values (e.g., ACL vs. monitoring result) should suffice. However, several factors must be accounted for when evaluating results and identifying exceedances. These factors are discussed below.

Significant Figures

Significant figures must be accounted for when comparing predicted values with measured values. The following general approach should be employed. For results less than 1,000 mg/l, comparisons between measured values and predicted values should be based on 2 significant figures. For results exceeding 1,000 mg/l, comparisons should be made on the basis of 3 significant figures. [Refer to Attachment M-1, Table 2 for a useful example.]

Verification Resampling

Verification resampling is an integral component of exceedance identification. To avoid "false positives" due to laboratory error and/or transient increases, a statistically significant exceedance will not be declared or reported until the results of verification resampling are known. Umetco's proposed approach to verification sampling is discussed below and in Table M-3.

4.2 ACL Constituents at Point of Compliance Wells

If any POC sample exceeds the ACL for one or more constituents, another sample will be analyzed within 3 months of obtaining the results, for the constituent(s), to rule out laboratory error or transient increase. If the first verification (re)sample also results in an exceedance of the same ACL, Umetco will notify the NRC within 30 days of receiving the second result. Contingent upon NRC approval, an additional verification sample may be collected before corrective action measures are considered (within 3 months of obtaining the second result).

If the second verification (re)sample also results in an exceedance, Umetco will provide an "action plan" to the NRC within 60 days of receiving the second verification sample results. This action plan will describe appropriate corrective action(s), if necessary, and/or further analysis to ensure that no risk will be incurred at Point of Exposure (POE) locations. Such an analysis may require reassessment of model simulations and assumptions. This approach is detailed in Table M-3.

4.3 Chloride and Sulfate at Model Validation Wells

As discussed above, chloride and sulfate are included in the monitoring plan for a subset of the non-POC wells to evaluate the predictions made by modeling and/or to track the downgradient migration of site-related constituents. As described in Table M-3, exceedance of the chloride and/or sulfate target levels will trigger additional response, including, but not limited to, confirmation sampling and/or reassessment of the model simulations and assumptions. Consideration will be given to the degree of the exceedance and the potential impacts to water quality at the POE. The potential for non-site related factors (e.g., mining impacts) must also be considered when identifying potential exceedances for these indicator parameters, in particular for sulfate. Response actions for exceedance of these parameters will be less rigorous than those discussed above for ACL constituents due to the conservatism already built into the model and the low probability that target level exceedances would adversely impact potential risks at POE locations.

Table M-3 Exceedance Identification and Action Approaches

Monitoring Endpoint	Exceedance Identification and Verification Resampling Approach	Actions to be Implemented if Exceedances are Verified
ACL Constituents at POC Wells	<p>If any POC sample exceeds the ACL for one or more constituents (accounting for significant figures), another sample will be analyzed <u>within 3 months</u> of obtaining the results for the constituent(s).</p> <p><i>[Re-analysis is only necessary for the constituent(s) exceeding the ACLs.]</i></p>	<p>If the first verification (re)sample also results in an exceedance of the same ACL, Umetco will notify the NRC within 30 days of receiving the second result. Contingent upon NRC approval, an additional verification sample may be collected before corrective action measures are considered (within 3 months of obtaining the second result).</p> <p>If the second verification (re)sample also results in an exceedance, Umetco will provide an "action plan" to the NRC within 60 days of receiving the second verification sample result. This action plan will describe appropriate corrective action(s), <i>if necessary</i>, and/or further analysis to ensure that no risk will be incurred at Point of Exposure (POE) locations. Such an analysis may require reassessment of model simulations and assumptions.</p>
Chloride and Sulfate in Model Validation Wells MW71B, MW28, MW72, and MW82	<p>If any sample exceeds the corresponding target level for chloride or sulfate (see Attachment M-1 tables), another sample will be analyzed <u>within 3 months</u> of obtaining the results. If the first verification sample also exceeds the target level(s), another verification sample will be collected (within 3 months of the first).</p>	<p>Exceedance of three consecutive samples—the annual sample, followed by two verification samples—is required before an exceedance of sulfate and chloride target levels is declared. NRC reporting requirements are the same as those identified above. Exceedances of chloride and/or sulfate target levels will trigger additional response, including but not limited to reassessment of the model simulations and assumptions.</p> <p>Corrective actions are not anticipated for these parameters, however, as exceedance of the target levels is expected to have a negligible impact on potential risks at the POE.</p>
Chloride, Sulfate, and Uranium-natural at Remaining Non-POC Wells	<p>None required. As indicated in Table M-2, <i>this sampling will be conducted for information and tracking purposes only</i>—i.e., results will not be assessed for exceedances.</p>	<p>Not Applicable.</p>

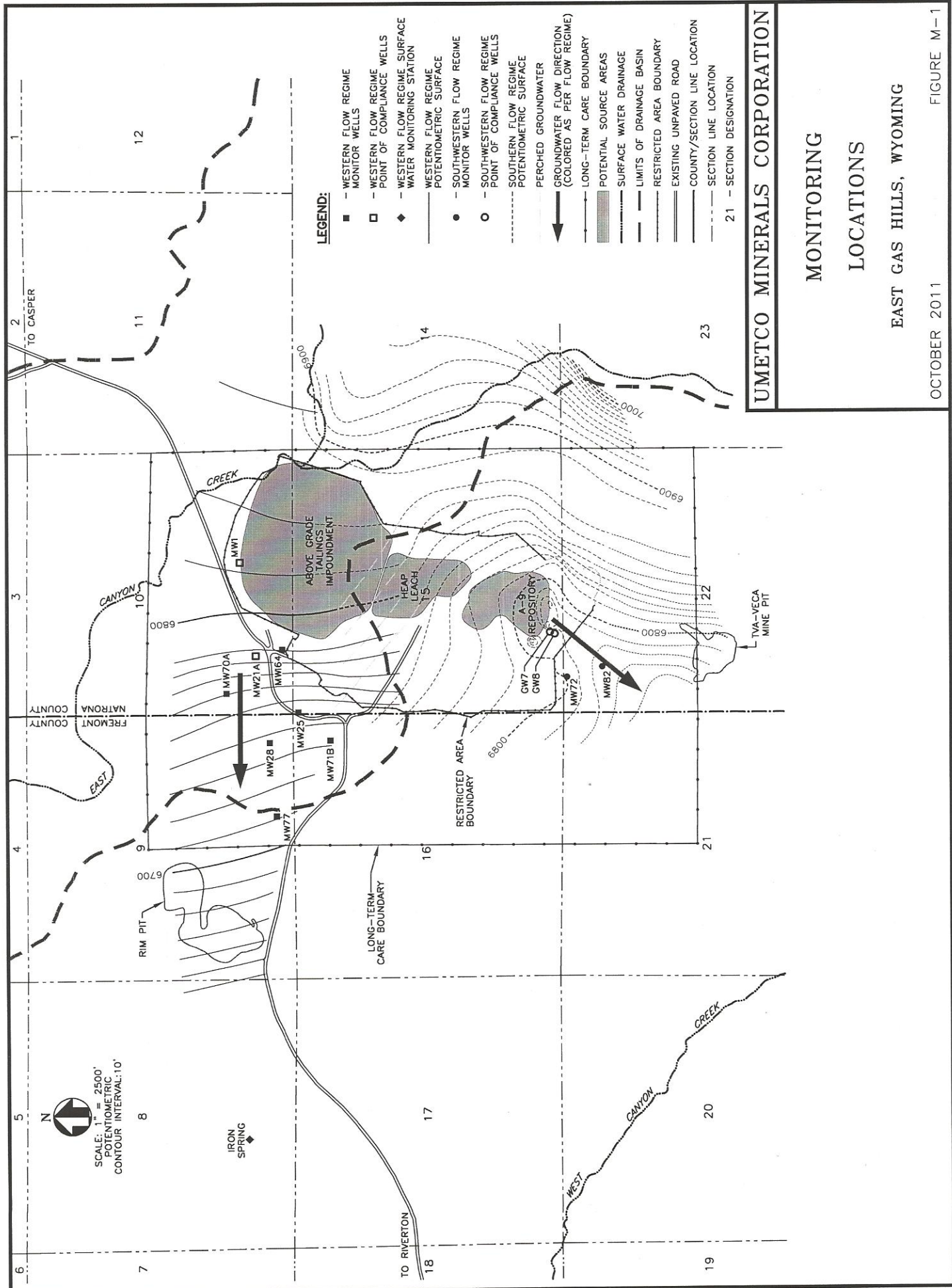


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