



Mr. Ken Kalman  
U.S. Nuclear Regulatory Commission  
11555 Rockville Pike  
Rockville, MD 20852-2738

Subject:

Revised Bioremediation Implementation Process Figure (Figure 5-1) from June 2008  
Groundwater Decommissioning Plan for Cimarron Site, Crescent, OK

Dear Mr. Kalman:

Cimarron Corporation (Cimarron) submitted an Addendum to the June 2008 Groundwater Decommissioning Plan (GDP) on September 4, 2008 at the request of the Nuclear Regulatory Commission (NRC). This Addendum discusses the success criteria to be established to evaluate the initial treatment testing results and to justify proceeding to full-scale remediation. A conference call was subsequently held on October 22, 2008 between Cimarron, ARCADIS, and the NRC to discuss the Addendum.

On behalf of Cimarron, ARCADIS is providing the attached revised Figure 5-1 depicting the Bioremediation Implementation Process proposed for the Cimarron site. As requested by the NRC during our October 22, 2008 conference call to discuss the Addendum, we have revised the Bioremediation Implementation Process figure (Figure 5-1 in the June 2008 GDP) to reflect the currently proposed bioremediation process for the Cimarron site, including achievement of the four success criteria prior to proceeding from initial treatment testing to full-scale remediation, and the completion of the laboratory column testing earlier in the overall treatment process. In addition, we have tied the proposed monitoring included in Table 5-1 more closely with each of the steps in the flow chart for clarity.

We look forward to the further technical discussion of the proposed laboratory column testing procedure with you. We would like to schedule a teleconference to conduct that discussion at your earliest convenience. Please let us or Mr. Jeff Lux at Cimarron know the available times and dates that would work for your team for the teleconference.

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ENVIRONMENT

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November 17, 2008

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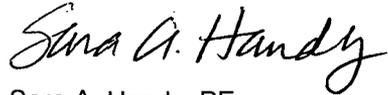
Imagine the result

ARCADIS

Mr. Ken Kalman  
November 17, 2008

Sincerely,

ARCADIS



Sara A. Handy, PE  
Certified Project Manager

Copies:

Mr. Jack Whitten, NRC Region IV  
Mr. Mike Broderick, ODEQ  
Mr. David Cates, ODEQ  
Mr. Jeff Lux, Cimarron

**Stage 1 – Development of Groundwater Decommissioning Plan/Conceptual Design**

Groundwater Decommissioning Plan Approval (by the NRC and ODEQ)

**Stage 2 – Baseline Sampling and Initial Treatment System Installation**

- Additional field characterization as needed in each of the three areas to advance the conceptual design to the initial treatment system design and baseline groundwater sampling (Table 5-1a); establish soils mineralogy baseline (Table 5-1b)
- Adjust site models and utilize outputs in initial treatment system design considerations
- Complete initial treatment system design for all 6 remediation systems
- Share new information with the NRC and ODEQ (estimated at 6 months from GDP approval)

Install and operate initial treatment system components in the forward, middle and rear portions of the groundwater areas of impact

Year 1

Utilize initial system installation efforts to collect:

- Groundwater water quality and flow information (Table 5-1c)
- Soils - iron mineralogy information (Table 5-1d)

Collect soil samples from initial treatment areas and conduct column testing per procedure in September 2008 Addendum to GDP to demonstrate (Table 5-1e):

- FeS to U ratio of 80:1 is achievable
- Oxidation of column does not result in leaching of U above 180 pCi/L
- Projected long-term water quality remains below 180 pCi/L U (eliminates need for long-term monitoring)

Initial Treatment Area Testing Results achieve Success Criteria in September 2008 Addendum to the GDP?

No

Yes

Update/adjust site models as appropriate and share new information with the NRC and ODEQ

Complete full-scale design

Year 2

**Stage 3 – Full-scale Systems Operation/Active Treatment**

- Expand treatment systems to complete functionality
- Initiate full-scale treatment throughout areas of elevated uranium impacts to groundwater

Continue to collect system operations and impacts data

**Monthly Groundwater Data Collection** (Table 5-1f)

- water quality sampling (full suite)
- flow information

Update/adjust site models as appropriate and share new information with the NRC and ODEQ

Make basic remediation system adjustments

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**Bioremediation Implementation Process**

Cimarron Corporation  
Crescent, Oklahoma

Date: 11/14/2008

FIGURE

**5-1**

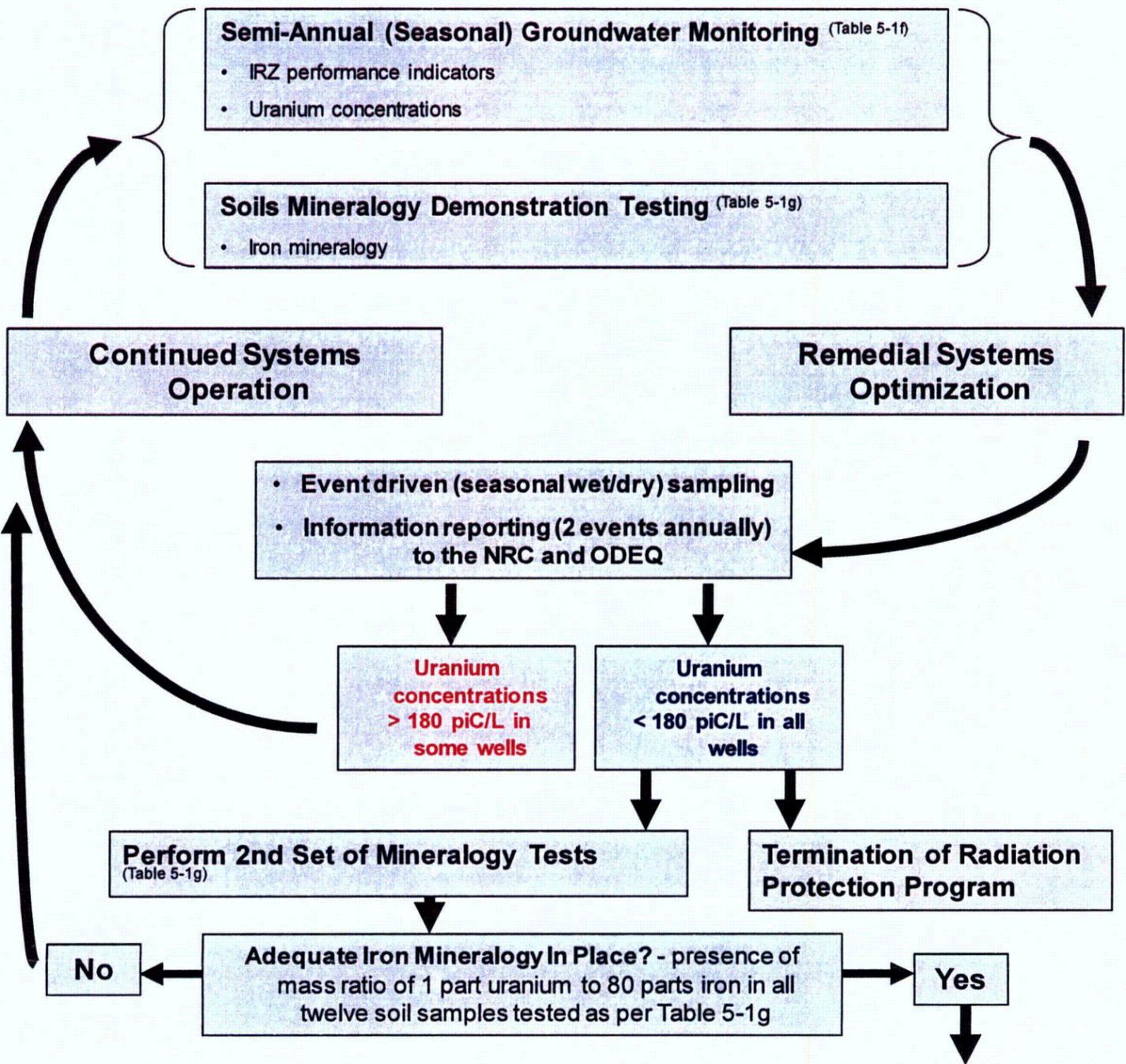
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Estimated  
Timeframe

- Year 3 -

Stage 3 Continued – Full-scale Systems Operation/Active Treatment

Active Treatment: 1 to 3 years



Stage 4 – Remedy Completion Demonstration and License Termination

2 years

Start of Remedy Completion Demonstration Testing

- Groundwater:
  - Collection of uranium concentration information and statistical trend analysis over 8 quarters (Table 5-1h)

**Successful Remediation Demonstrations = License Termination**

License termination shall be granted upon the successful demonstration that:

- Results of soil analyses for iron mineralogy demonstrate that iron sulfide mass has accumulated to the required mass ratio of 1 part uranium to 80 parts iron, as evaluated in the column testing performed during the initial treatment.
- Groundwater samples collected from 32 wells located in BA#1, WAA and WUA consistently show uranium concentrations below 180 piC/L and 110 ug/L.
- 16 demonstration wells across BA#1, WAA and WUA do not show statistically significant positive trend in uranium concentrations in 8 quarters of data using USEPA-approved statistical methods.

License Termination Process:

- Submit license termination request (estimated submission at the start of year 7 or earlier based upon remedial performance)
- Achieve license termination (no later than start of year 8)

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Bioremediation  
Implementation Process

Cimarron Corporation  
Crescent, Oklahoma

Date: 11/14/2008

FIGURE

5-1

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**Table 5-1. Summary of Baseline, Performance, and Remedy Completion Demonstration Monitoring**

# of Sampling Locations	Sampling Frequency	Analyses to be Conducted
<b>Stage 2: Baseline Monitoring</b>		
<b>6-1a: Groundwater Monitoring:</b>		
32 wells across all 3 areas: BA#1, WAA, WUA	One-time sampling event	<ul style="list-style-type: none"> <li>• Water levels</li> <li>• pH</li> <li>• Temperature</li> <li>• Dissolved oxygen</li> <li>• Total organic carbon</li> <li>• Total dissolved solids</li> <li>• Alkalinity</li> <li>• Sulfate/sulfide</li> <li>• Nitrate/nitrite</li> <li>• Dissolved/ferrous iron</li> <li>• Uranium – total activity, isotopic, mass concentration</li> </ul>
<b>6-1b: Soil Monitoring:</b>		
3 borings installed within each alluvial area of impact with 2 soil samples from different depth intervals in each boring (total of 6 samples total from each alluvial area of impact)*	One-time sampling event	<ul style="list-style-type: none"> <li>• Bulk iron mineralogy including:                             <ul style="list-style-type: none"> <li>○ selective chemical extraction</li> <li>○ x-ray diffraction</li> </ul> </li> <li>• Iron sulfide content quantification</li> <li>• Uranium – total activity, isotopic, mass concentration</li> <li>• Induced mineralogy changes including microprobe methods to examine soil mineralogy changes induced by TOC addition and anaerobic microbial processes using:                             <ul style="list-style-type: none"> <li>○ SEM with EDS</li> <li>○ <math>\mu</math>-XRF</li> <li>○ <math>\mu</math>-XANES</li> </ul> </li> </ul>
<b>Stage 2: Initial Treatment System Installation</b>		
<b>6-1c: Groundwater Monitoring:</b>		
12 wells – 2 wells within each of the 6 Initial Treatment Areas	Initially daily then weekly for tracer, water levels and field parameters for first month; monthly for other parameters during estimated 3-4 month Initial Treatment System Installation testing phase	<ul style="list-style-type: none"> <li>• Tracer</li> <li>• pH</li> <li>• Temperature</li> <li>• Dissolved oxygen</li> <li>• Total organic carbon</li> <li>• Total dissolved solids</li> <li>• Alkalinity</li> <li>• Sulfate/sulfide</li> <li>• Nitrate/nitrite</li> <li>• Dissolved/ferrous iron</li> <li>• Uranium – total activity, isotopic, mass concentration</li> </ul>
<b>6-1d: Soil Monitoring:</b>		
One soil boring installed within each of the 6 Initial Treatment Areas (total of 6 soil samples)	Minimum of one sampling event based on observed results.	<ul style="list-style-type: none"> <li>• Bulk iron mineralogy including:                             <ul style="list-style-type: none"> <li>○ selective chemical extraction</li> <li>○ x-ray diffraction</li> </ul> </li> <li>• Iron sulfide content quantification</li> <li>• Uranium – total activity, isotopic, mass concentration</li> <li>• Induced mineralogy changes including microprobe methods to examine soil mineralogy changes induced by TOC addition and anaerobic microbial processes using:                             <ul style="list-style-type: none"> <li>○ SEM with EDS</li> <li>○ <math>\mu</math>-XRF</li> <li>○ <math>\mu</math>-XANES</li> </ul> </li> </ul>
<b>6-1e: Soil Oxidative Aging Testing:</b>		
Laboratory Column Studies	During initial treatment system installation (pilot testing phase)	Column testing to assess: <ul style="list-style-type: none"> <li>• Oxygen consumption</li> <li>• Iron oxidation</li> </ul> Oxidative aging testing to be conducted using a PNNL methodology (Thornton et al 2007) as described in Attachment A to the September 2008 GDP Addendum
<b>Stage 3: Performance Monitoring:</b>		
<b>6-1f: Groundwater Monitoring:</b>		
32 wells across all 3 areas: BA#1, WAA, WUA	Monthly for the first 6 months of IRZ operation	<ul style="list-style-type: none"> <li>• pH</li> <li>• Temperature</li> <li>• Dissolved oxygen</li> <li>• Total organic carbon</li> <li>• Total dissolved solids</li> <li>• Alkalinity</li> <li>• Sulfate/sulfide</li> <li>• Nitrate/nitrite</li> <li>• Dissolved/ferrous iron</li> <li>• Uranium – total activity, isotopic, mass concentration</li> </ul>
	Semi-annually starting 12 months after start of IRZ operation and continuing until the start of remedy completion demonstration testing for groundwater.	
<b>6-1g: Soil Monitoring:</b>		
3 borings installed within each alluvial area of impact with 2 soil samples from different depth intervals in each boring (total of 6 samples total from each alluvial area of impact)*	Minimum of two sampling events based on observed results	<ul style="list-style-type: none"> <li>• Bulk iron mineralogy including:                             <ul style="list-style-type: none"> <li>○ selective chemical extraction</li> <li>○ x-ray diffraction</li> </ul> </li> <li>• Iron sulfide content quantification</li> <li>• Uranium – total activity, isotopic, mass concentration</li> <li>• Induced mineralogy changes including microprobe methods to examine soil mineralogy changes induced by TOC addition and anaerobic microbial processes using:                             <ul style="list-style-type: none"> <li>○ SEM with EDS</li> <li>○ <math>\mu</math>-XRF</li> <li>○ <math>\mu</math>-XANES</li> </ul> </li> </ul>
<b>Stage 4: Remedy Completion Demonstration Monitoring:</b>		
<b>6-1h: Groundwater Monitoring:</b>		
16 wells across all 3 areas: BA#1, WAA, WUA	Quarterly for 8 quarters	<ul style="list-style-type: none"> <li>• Uranium – total activity, isotopic, mass concentration</li> </ul>

a - Locations for sampling will be selected so that soil is retrieved from 1) within the areas of the highest concentration of uranium in groundwater at the start of remediation, 2) within the leading edge of the area of uranium impacts, and 3) within the area of uranium impacts upgradient from the highest concentration location. The selection of locations for sampling will be refined as the groundwater remediation progresses.

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**Bioremediation  
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Cimarron Corporation  
Crescent, Oklahoma

Date: 04/18/2008
FIGURE  <b>5-1</b>
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