



May 21, 2010

John Martin, PhD, PE  
Senior Project Manager, Energy Resources R&D  
NYSERDA  
17 Columbia Circle  
Albany, NY 12203

Kathleen F. Sanford  
Assistant Director  
NYSDEC – Division of Mineral Resources  
625 Broadway, 3<sup>rd</sup> Floor  
Albany, NY 12233-6500

Re: Revisions to URS Report on Water-Related Issues Associated with Gas Production in the Marcellus Shale: Additives Use, Flowback Quality and Quantities, Regulations, On-site Treatment, Green Technologies, Alternate Water Sources, and Water Well-Testing, dated September 16, 2009

Dear Dr. Martin and Ms. Sanford:

Transmitted herewith is URS Corporation's Report in support of the Supplemental Generic Environmental Impact Statement, revised as requested by the New York State Department Environmental Conservation (NYSDEC) to reflect a typographical correction, to delete laboratory quality control parameters and to incorporate previously omitted data.

Text and conclusions in the URS report remain unchanged. The revisions are limited to Tables 3-1, and 4-4 through 4-7. A brief description of the URS scope and the details of the revisions are provided below

**Scope of URS' Services**

URS' scope for this report was to review and analyze the water-related impacts of horizontal drilling and high-volume hydraulic fracturing of tight formations, focusing specifically on the following elements:

- A. Fracture fluid additives
- B. Flowback fluids
- C. Sufficiency of regulations and guidelines
- D. On-site flowback fluids treatment or recycling technologies
- E. Potential 'green' (non-chemical based) hydraulic fracturing technologies
- F. Alternate water sources for hydraulic fracturing operations
- G. Water well sampling needs

Input received, and therefore addressed in this letter are primarily related to Task B.

Under Task B, URS was to review information that has been collected by the NYSDEC regarding the volumes and composition of flowback fluids from hydraulic fracturing operations. Based on information available in the literature, from NYSDEC, or others, URS was to provide a qualitative trend analysis of changes in flowback characteristics over time.

Since submitting the URS report, NYSDEC and the New York State Department of Health identified discrepancies in the URS report. The following sections describe the revisions to the report to address the agency comments.

**Revision 1: Deleted 4-Nitroquinoline-1-oxide (CAS<sup>1</sup> 00056-57-5) from Tables 3-1, 4-4 and 4-5**

The compound 4-Nitroquinoline-1-oxide was included in the initial report due to a typographical error; the data presented under this compound is for alkalinity (measured as calcium carbonate). The compound has been deleted in the revised report.

Tables 3-1, 4-4 and 4-5 have been corrected; the compound 4-Nitroquinoline-1-oxide has been deleted because it was not found in detectable levels in any flowback analysis provided to URS by industry via NYSDEC. Alkalinity, measured as calcium carbonate, was already included in Tables 3-1 and 4-4. Total Number of Samples, Number of Detects, Minimum Detected Concentration, Median Detected Concentration, and Maximum Detected Concentration associated with alkalinity (as calcium carbonate) in Table 4-5 have been updated to include those values previously listed under 4-Nitroquinoline-1-oxide.

**Revision 2: Deleted readings with units “% REC” from flowback information**

The original flowback-related tables in the URS report included Quality Control (QC) information, like “%REC”, that is internal to the analytical laboratories. However, upon reflection, URS agrees that this information does not provide insight to the quality of flowback. Therefore all data with units “%REC” have been removed from the URS Master Database and the following compounds, which have units “%REC”, have been deleted from the report.

<b>Compound</b>	<b>Tables compound deleted from</b>
1,1,1-Trifluorotoluene	Tables 3-1, 4-4, 4-6 and 4-7
1,4-Dichlorobutane	Tables 3-1, 4-4 and 4-5

<sup>1</sup> Chemical Abstracts Service (CAS)  
URS Corporation  
335 Commerce Drive, Suite 300  
Fort Washington, PA 19034  
Tel: 215.367.2500  
Fax: 215.367.1000

<b>Compound</b>	<b>Tables compound deleted from</b>
2,4,6-Tribromophenol	Tables 3-1, 4-4 and 4-5
2,5-Dibromotoluene	Tables 3-1, 4-4, 4-6 and 4-7
2-Fluorobiphenyl	Tables 3-1, 4-4 and 4-5
2-Fluorophenol	Tables 3-1, 4-4 and 4-5
4-Terphenyl-d14	Tables 3-1, 4-4 and 4-5
Nitrobenzene-d5	Tables 3-1, 4-4, 4-6 and 4-7
o-Terphenyl	Tables 3-1, 4-4 and 4-5
Phenol-d5	Table 4-4 (other tables unaffected as previously included under phenols)

**Revision 3: Include additional flowback analyses in Tables 3-1, and 4-4 through 4-7**

Tables 3-1, and 4-4 through 4-7 have been updated to include all flowback analyses received from industry via NYSDEC. This revision was performed in two stages.

Stage 1 revisions: Consistent with URS’ scope to identify presence/absence of constituents in flowback, URS compiled a working database of flowback constituents to include in the URS report. Four datasets with partial analyte lists were excluded because all the analytes in these four datasets were already represented in the Master Database. The partial analyte lists with the associated data are now included in the Master Database.

Stage 2 revisions: Based on the file name “water samples,” nine (9) datasets were excluded from the Master Database. Further review of constituent concentrations revealed that the “water samples” were, in fact, flowback analyses. These datasets are also now included in the Master Database.

Tables 3-1, 4-4, 4-5, 4-6 and 4-7 in the report have been updated correspondingly.

**Revision 4: Expand Table 4-5 to include those constituents indirectly regulated**

URS’ initial report listed Total Number of Samples, Number of Detects, Minimum Detected Concentration, Median Detected Concentration, and Maximum Detected Concentration in Table 4-5 when constituents are directly regulated; those constituents that are indirectly regulated were not separately listed.

Table 4-5 now includes the dissolved components of metals also, even though they are not directly regulated.

Senior Project Manager, Energy Resources R&D  
NYSERDA  
Assistant Director  
NYSDEC – Division of Mineral Resources  
May 21, 2010  
Page 4 of 5

**Revision 5: Table 4-4 updated to be consistent with Table 2-2**

Table 2-2 lists chemical constituents reported in additives used or proposed for use in the state of New York. Table 2-2 remains unchanged.

Table 4-4 has been updated to list xylene as a constituent found in additives, consistent with Table 2-2.

In addition, water and all the variations of ethoxylated alcohol, guar gum and potassium borate reported under different CAS numbers have been added to Table 4-4 to be consistent with Table 2-2. The initial report listed these compounds only once.

Please do not hesitate to contact us with questions or clarifications.

Sincerely,



Radhika de Silva, PhD, PE  
Project Manager