

## Summary of Recent Incidents Involving the Release of Chemicals

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**PRESCO DRILLING MUD DAYLIGHTS IN STREAM:** In October, 2005, PRESCO, Inc. (PRESCO) was drilling a well on Battlement Mesa, in Garfield County. While drilling a borehole to set the surface casing for the BM 36-23 well, the drilling mud “daylighted.” According to the company, the borehole apparently intersected a fracture, which conveyed the drilling mud to the ground surface.<sup>1</sup> The leak was first discovered coming out of a natural spring, on a hillside approximately 1/4 mile from the drilling rig.

According to a report sent by Cordilleran Compliance Services, Inc. to Robert Chesson of the COGCC, “the drilling mud leak eventually made its way to Battlement Creek causing a visible, ‘milky-white’ color change in the creek due to the turbidity. The effects of the mud leak were visible for at least 3 1/2 miles down stream.”<sup>2</sup>

According to Cordilleran, the drilling mud consisted of “fresh water, bentonite gel, polymer, and lime.”<sup>3</sup> The Material Safety Data Sheet (MSDS) for the drilling mud Quik-Gel, supplied to Cordilleran, showed that in addition to bentonite, the drilling mud contained three types of crystalline silica (cristobalite, tridymite and quartz). There was no mention of lime in the MSDS.<sup>4</sup>

The National Lime Association’s Fact Sheet *Lime Safety Precautions* states that “care should be taken to avoid accidental mixing of quicklime and water (in any form, including chemicals containing water of hydration) to avoid creating excessive heat. Heat released by this reaction can ignite combustible materials or cause thermal damage to property or person.”<sup>5</sup>

The COGCC issued a notice of alleged violation (NOAV) on November 21, 2005, for an “unpermitted discharge of any fluids into water of the State.” On the NOAV, the COGCC required the company to describe all operational changes Presco will implement on future drilling operations to mitigate uncontrolled release of E&P fluids from drillsites, including contingency plans to manage a release without resulting in an

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<sup>1</sup> Colorado Oil and Gas Information System (COGIS) Spill report. 10/14/2005. Filed by PRESCO Inc. for the Battlement Mesa 36-23 well; and COGIS Field Inspection Report, 10/14/2005, for Battlement Mesa #36-23 well.

<sup>2</sup> February 7, 2006. Letter from Cordilleran Compliance Services, Inc. (Cordilleran) to Robert Chesson, COGCC, Re: Notice of Alleged Violation for Uncontrolled and Uncontained Drilling Mud at the PRESCO, Inc. Battlement Mesa 36-23 Gas Well Site that Occurred on 14 October 2005 – Cordilleran Project #E04243. <http://ogcc.viis.state.co.us/cgi-bin/search?id=0&classid=26&120=200078321>

<sup>3</sup> February 7, 2006. Letter from Cordilleran to Robert Chesson, COGCC. p. 2.

<sup>4</sup> Halliburton. Material Safety Data Sheet for Quick-Gel ®. Included in February 7, 2006. Letter from Cordilleran Compliance Services, Inc. (Cordilleran) to Robert Chesson, COGCC.

<sup>5</sup> National Lime Association. <http://www.lime.org/faqs.html> Fact Sheet *Lime Safety Precautions* <http://www.lime.org/FactSafety12403.pdf> (Accessed 05/26/2006)

uncontrolled discharge into surface water of the State.<sup>6</sup> The COGCC case regarding this spill was closed on the same date.<sup>7</sup>

**KERR McGEE FRACKING FLUID AFFECTS SOIL AND IRRIGATION DITCH:**

On October 4, 2005, a valve on a the wellhead of Cannon Land 7-35 well failed, resulting in the release of between 168-210 gallons of fluids that returned to the surface from an hydraulic fracturing operation. The fluid sprayed into the air and drifted offsite, primarily onto pasture land, resulting in a visible coating that was as much as 1/2 inch thick.<sup>8</sup> The company estimated that 15-20 gallons of the fluid entered the Platteville Lateral irrigation ditch, which contained some standing water but was not flowing at the time that the fluids entered it.

The fracturing fluid contained Potassium Chloride (2%), as well as a surfactant (DWP-931, run at 1.5 gallons/1000 gallons of water), and friction reducer (DWP-601, run at 0.5 gallons/1000 gallons of water).<sup>9</sup> DWP-931 contains a host of potentially toxic substances, including ethoxylated nonylphenol (15-40%); trimethylbenzene (3-7 %), light aromatic naphtha (3-13%); oxyalkylated phenolic resin (15-40%); ethylbenzene (0-2%); xylene (3-13 %); and isobutyl alcohol (10-30%).<sup>10</sup> DWP-601 contains 1-5% ethoxylated nonylphenol.<sup>11</sup>

According to an Oct. 4, 2005 email from COGCC to the Water Quality Control Division of CDPHE, this spill/release “would be classified as non-significant.”<sup>12</sup>

**MARALEX DRILLING FLUIDS IN DRINKING WATER:** On October 30, 2005, a landowner contacted COGCC regarding potential contamination of his water well by fluids in a nearby drilling reserve pit. The unlined reserve pit for the Keegan Patrick 33-7-11 #2A well, which was operated by Maralex Resources, Inc., was located about 350 feet uphill from the affected water well. Based on information collected by COGCC, “it appears that fluids from the unlined reserve pit infiltrated into the shallow groundwater, flowed downhill and impacted the . . . water well.”<sup>13</sup>

Water quality samples from the landowner’s well revealed elevated concentrations of calcium, chloride and total dissolved solids compared to neighboring water wells, and concentrations of chlorides that exceeded Colorado water quality standards.

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<sup>6</sup> COGIC- NOAV Report. 10/21/2005. Issued to Presco, Inc. for Battlement Mesa #36-23 well.

<sup>7</sup> COGIC- NOAV Report. 10/21/2005. Issued to Presco, Inc. for Battlement Mesa #36-23 well.

<sup>8</sup> Oct. 7, 2005. Letter from Paul Schneider, Kerr-McGee to Forrest Vaughn, Colorado Department of Public Health and Environment.

<sup>9</sup> Letter from Paul Schneider, Kerr-McGee to Forrest Vaughn, Colorado Department of Public Health and Environment. Oct. 7, 2005.

<sup>10</sup> Cal-frac Well Services Ltd. May 14, 2004. Material Safety Data Sheet for DWP-931 Fracturing fluid additive. Included in Oct. 7, 2005 letter from Kerr-McGee to CDPHE.

<sup>11</sup> Cal-frac Well Services Ltd. Sept 19, 2002. Material Safety Data Sheet for DWP-601 Oilfield additive. Included in Oct. 7, 2005 letter from Kerr-McGee to CDPHE.

<sup>12</sup> October 5, 2005. Email from Randall Ferguson, COGCC, to Jeffrey Coombe and BethAnne Williams. Electronic document in COGCC Remediation Project 3641.

<sup>13</sup> Notice of Alleged Violation Report. 10/30/2005. Issued by COGCC to Maralex Resources Inc. COGIS document number 200085988. [http://oil-gas.state.co.us/cogis/NOAVReport.asp?doc\\_num=200085988](http://oil-gas.state.co.us/cogis/NOAVReport.asp?doc_num=200085988)

According to the COGCC, during the cementing process, calcium chloride<sup>14</sup> and other additives, like Halad-344, were added to the cement at different phases.<sup>15</sup>

Steve Lindblom of COGCC, the COGCC requested of Maralex copies of the MSDSs for the chemical additives and products used during their drilling operations. The request was made in December of 2005, and COGCC received the information a few months later.<sup>16</sup>

OGAP obtained copies of the MSDSs from COGCC.<sup>17</sup> There were at least 19 products used during the drilling of the Maralex well. Many of the products contained chemicals known to be harmful to human health and the environment. For example, products contained ethoxylated nonylphenols,<sup>18</sup> isopropanol,<sup>19</sup> 2-bromo-2-nitropropane-1,3-diol,<sup>20</sup> acrylamide,<sup>21</sup> and dipropylene glycol monomethyl ether.<sup>22</sup> Additionally, hydrochloric and hydrofluoric acids were used at various stages during the drilling process.

At no time after receiving the MSDSs, did the COGCC require the company to sample for any of the more complex chemical additives used during the drilling process (e.g., nonylphenol, acrylamide, etc.). The water quality sampling regime for consisted of the standard inorganic analysis (e.g., for salts, metals), and during the initial sampling period the company was required to sample for volatile organic compounds.<sup>23</sup>

The COGCC request for information did not result in the full disclosure of all chemical products used by Maralex in their drilling operations. MSDSs were not included for two Halliburton products, HAI-81M (only a Transportation Emergency Response Information sheet was submitted for this product; it did not contain specific chemical names) and Halad-344 (data submitted by the company to COGCC shows that this product was used during the drilling process).<sup>24</sup>

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<sup>14</sup> Sundry Notice, Form 4, submitted to COGCC by Maralex Resources Inc. Report of work completed on Keegan Patrick 33-7-11 #2A well, 07/27/2005. (Halliburton Job Summary attached to Sundry notice).

<sup>15</sup> Sundry Notice, Form 4, submitted to COGCC by Maralex Resources Inc. Report of work completed on Keegan Patrick 33-7-11 #2A 08/09/2005. Halliburton Job Summary attached. COGCC web site.

<sup>16</sup> Pers. Communication between Steve Lindblom and Lisa Sumi. 06/16/2006.

<sup>17</sup> Pers. Communication between Steve Lindblom and Lisa Sumi. 06/05/2006.

<sup>18</sup> There was an unidentified "Surfactant" on the Material Safety Data Sheet for the product LOSURF-300 Non-Ionic Surfactant, which was provided by Maralex to COGCC (Halliburton MSDS (2001/58/EC) for LOSURF-300 Non-Ionic Surfactant. An MSDS for a Halliburton product called "LOSURF-300 Non-Ionic Surfactant" was obtained from the Gunnison Energy Web Site ([http://www.northforkvalley.com/pdf/MSDS/LOSURF-300\\_NONIONIC\\_SURFACTANT.pdf](http://www.northforkvalley.com/pdf/MSDS/LOSURF-300_NONIONIC_SURFACTANT.pdf)), and in this MSDS the surfactant was identified as ethoxylated nonylphenol.

<sup>19</sup> Halliburton MSDS (2001/58/EC) for LOSURF-300 Non-Ionic Surfactant.

<sup>20</sup> Halliburton Transport Emergency Response Information (Road) for product BE-6 Microbiocide.

<sup>21</sup> MiSWACO MSDS for "Poly-Plus\*".

<sup>22</sup> Halliburton MSDS (2001/58/ED) for SandWedge NT.

<sup>23</sup> Pers. Communication between Steve Lindblom and Lisa Sumi. 06/16/2006.

<sup>24</sup> Form 4, Sundry Notice, filed by Maralex. Received by COGCC September 1, 2005. Form can be downloaded from Colorado Oil and Gas Information System. <http://ogcc.viis.state.co.us/cgi-bin/openobj.EXE?ID=8475504&DOCID=YDN5PAUHKNKR6XMZ&CLASSID=49>

Based on preliminary research into these two products, OGAP has found that they likely contain chemicals that are harmful to human health.

- HAI-81M is an acid inhibitor product from Halliburton. BJ Services, a competing company, has produced an acid inhibitor that it touts as being “greener” than HAI-81M. The BJ Services product, CI-27, “contains no nonyl phenol ethoxyolates, quaternaries, aromatic solvents or heavy metals.”<sup>25</sup>
- Halad-344 may contain N,N-dimethylformamide, 2-acrylamido-2-methylpropane sulfonic acid;<sup>26</sup> and N,N-dimethyl acrylamide.<sup>27</sup> N,N-dimethylformamide is a suspected toxicant for many physiological systems (respiratory, skin, eyes, liver, cardiovascular, and several others).<sup>28</sup>

Not knowing exactly what was in his water presented a potential health risk to the landowner. During the period of time when some of the drilling constituents were at elevated levels in his water well, the landowner did not drink his well water. But he continued to bathe in it, and to water his livestock. Some of the chemicals that were used during the drilling process can be absorbed through the skin, or their vapor could be inhaled while having a hot shower.

This incident shows that the status quo, i.e., not requiring disclosure of toxic chemicals, put the landowner at a serious disadvantage, since there was no way to know exactly what chemicals to look for in his water samples.

## **BARRETT CONDENSATE AND FLOWBACK PRODUCTS IN AIR:**

### **Citizen Complaints**

Between September and December, 2005, the COGCC documented 10 complaints from eight separate households related to odors emanating from wells being drilled and completed by Bill Barrett Corporation (“Barrett”).

9/16/2005: Elizabeth Vath, Gayle Hartop and Teran Hughes complained separately to the COGCC about smoke/haze/odors from a nearby well pad. In the COGIS Complaint report for this incident, it is revealed that additional cementing work had to be done on a Barrett well, so pressure in the well was released. Typically, Barrett would sparge the

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<sup>25</sup> BJ Services CI-27 Product Information.

[http://www.bjservices.com/website/ps.nsf/8adf5662b6e4d0d486256a4800533ab3/601bdca5f72e23a086256a64005c7743/\\$FILE/ST-CI-27.pdf](http://www.bjservices.com/website/ps.nsf/8adf5662b6e4d0d486256a4800533ab3/601bdca5f72e23a086256a64005c7743/$FILE/ST-CI-27.pdf)

<sup>26</sup> <http://appft1.uspto.gov/netacgi/nph->

Parser?Sect1=PTO1&Sect2=HITOFF&d=PGO1&p=1&u=%2Fmetahtml%2FPTO%2Fsrchnum.html&r=1&f=G&l=1&s1='20030159625'.PGNR.&OS=DN/20030159625&RS=DN/20030159625

<sup>27</sup> <http://appft1.uspto.gov/netacgi/nph->

Parser?Sect1=PTO2&Sect2=HITOFF&u=%2Fmetahtml%2FPTO%2Fsearch-adv.html&r=4&p=1&f=G&l=50&d=PGO1&S1=halad-344&OS=halad-344&RS=halad-344

<sup>28</sup> Scorecard. Acrylonitrile (CAS 107-13-1) and N,N-dimethylformamide (CAS 68-12-2).

<http://www.scorecard.org/chemical-profiles/>

accumulated gases through reserve pit fluid. In this case, however, because the pit was almost empty, the gases were vented directly to the atmosphere. There was no mention of any air quality monitoring occurring at the complainants' homes or at the well site.

9/22/2005: Oni Butterfly, a landowner living near Barrett's Louthan well, complained of fumes/odors that left her "gagging." The "stench" was so bad that she found it difficult to be at home, especially outside.<sup>29</sup>

10/18/2005: Dion and Debbie Enlow complained about odors from a Barrett wellpad upwind from their home. The pad had four wells that were undergoing completion/hydraulic fracturing. COGCC staff investigated and found flowback in one half of the unlined pit. The other side of the pit was "really dark and oily in appearance." The complaint report states that the "Enlow residence is down in a hollow, 1/4 miles or so from well-pad. Fumes and such can accumulate there. . . [Barrett is] trying to complete this loc[ation] ASAP."<sup>30</sup> According to Dion Enlow, he complained to the company that the smell was so bad that "I can't go outside and breathe." Enlow was not aware of either the company or any agencies actually sampling the air quality in response to his complaints.<sup>31</sup>

10/19/2005: Oni Butterfly filed another complaint about the odors from the Barrett wells. There had recently been a problem with a nearby well location, and with tanks overflowing.<sup>32</sup> According to the COGCC Complaint report on this incident,<sup>33</sup> Garfield county environment staff would install monitoring equipment at her house to take a monthly air quality reading, and leave a Suma air sampler to that Ms. Butterfly could take an air sample when the odors were especially bad. This is the only example, in these COGCC complaints, of air samples being taken in response to odors from Barrett pits.

10/25:2006: COGCC was called by the Enslow family, who related that odors were so severe that they could not remain outside to cook on their grill. Debbie Enslow also said that she and her husband were "not prone to headaches but have been getting them due to pit odor/vapors," and that they were also "feeling rundown and listless." Jay Krabacher of COGCC and a Barrett representative went to the Enslow residence and according to Krabacher, "we all could smell intermittent (but persistent) odors." Krabacher investigated options for mitigating pit odors, and was told that "Schumberger and BJ [Services] have 'industrial strength' powdered bleach which, when added to the pit fluid, is pumped and circulated. . . works quickly." Krabacher visited the Wilson pad near the Enslows and stuck a finger in the pit; in the complaint report he notes that "there was a slight condensate odor – which could be detected on my finger hours later."<sup>34</sup>

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<sup>29</sup> COGIS Complaint Report. Complaint date 9/22/2005. Document number 200081430.

<sup>30</sup> COGIS Complaint Report. Complalint date 10/18/2005. Document number 200082039.

<sup>31</sup> Pers. Communication between Dion Enslow and Lisa Sumi. 06/06/2006.

<sup>32</sup> COGIS Complaint Report. Complaint date 10/19/2005. Document number 200081429.

<sup>33</sup> *ibid.*

<sup>34</sup> COGIS Complaint Report. Complaint date 10/25/2005. Document number 200082049.

11/1/2005: Sherry Tardiff contacted the COGCC regarding “nauseating odors from Anchondo pad.” COGCC staff, Jay Krabacher, went to the location to “sniff around,” and detected a “slight odor.” He was told by a Barrett employee that Anchondo was a “real active well,” and that during the day the gas was being vented under the pit surface to a tank. Krabacher also reports that that hot flowback water “becomes very steamy upon hitting surface, and there was some odor.”<sup>35</sup>

11/1/2005: Dion Enslow reported “a large cloud of steam/vapor” extending for approximately 1/4 mile from the Wilson pad, which was undergoing a workover prior to hydraulic fracturing. The Enslows were “somewhat apprehensive of the contents of the cloud. The crew foreman speculated that the steam cloud could be the result of hot (170 - 190° F) produced water hitting the cold air, which sounded “reasonable” to Krabacher and the Enslows. There was no investigation into what compounds might be volatilizing when the hot produced water hit the surface.

11/15/2005: The Enslows left a message for COGCC at 5:30 in the morning, stating that “odor worse than it’s been.” Enslow had gone up to the Wilson pad location and had observed “gnarly/oily” fluid in the pit. Barrett had just completed its final hydraulic fracturing flowback operation at that site. The well had been hydraulic fractured with “slickwater,”<sup>36</sup> which according to Jennifer Miskimins of the Colorado School of Mines, may contain chemicals such as “a friction reducer, surfactants, and clay stabilizers.”<sup>37</sup> Jay Krabacher of COGCC noticed a “slight odor” at the Wilson well pad, and was assured by the company that the location would be completed and pit reclamation would begin soon thereafter. Enslow reports that the flow-tester working for Barrett assured him that if the Enslows had any problem he’d “take care of it.”<sup>38</sup>

11/21/2005: Oni Butterfly contacted the COGCC several times to complain about odors from area wells. Ms. Butterfly asked about the “stuff” on the surface of the Louthan pit, and was given the “guar gum tutorial” by Jay Krabacker. She was told that the stuff on pit surfaces is “mostly environmentally benign,” although sometimes “odiferous.”

12/05/2006 – 12/29/06: Ms. Butterfly called the COGCC to complaint about “a different sort of stench, still very bad.” The next day she called again, referring to it as a “benzene smell.” She asked that the COGCC try to procure a full-time, outdoor air-monitoring device and an air pollution control device for the inside of her house. On the 29<sup>th</sup> of December, Ms. Butterfly called COGCC again, to report a strong odor experienced at 4:30 that morning. On December 30, Butterfly was informed by Garfield County that an air quality sample had been taken on Chipperfield Lane, which was fairly close to the Laughlin Pit, on October 25, 2005.<sup>39</sup> Results from the sampling showed that benzene and

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<sup>35</sup> COGIS Complaint Report. Complaint date 11/1/2005. Document number 200081427.

<sup>36</sup> COGCC Form 5A. Complete interval report filed by Bill Barrett Corporation for the Wilson 33D-23-692 well. Processed 12/20/05. Document number 01526602

<sup>37</sup> Petroleum Technology Transfer Council of the Rockies Newsletter. 2003. Vol.6;4. J. Miskimins. “Slickwater Fracs.” <http://www.mines.edu/Research/PTTC/newsletters/volume%206/v6n4p2.html>

<sup>38</sup> COGIS Complaint Report. Complaint date 11/15/2005. Document number 200082058.

<sup>39</sup> Letter and air quality test results sent from Garfield County to Oni Butterfly. 12/30/2005.

xylenes exceeded the U.S. Environmental Protection Agency's "non-cancer risk levels" for these compounds – at 67 µg/m<sup>3</sup>, benzene was present at more than double the risk level. Other detectable compounds included acetone, toluene and ethylbenzene.

### **Notices of Alleged Violation (NOAVs)**

Between October 18 and December 28, 2005, Barrett was issued nine NOAVs. The violations included transporting condensate wastes offsite without a permit; burning wastes at a site not authorized as a waste disposal site; allowing fluids to fill pits above allowable levels; not reporting the spill of "frac flowback" fluid outside of a pit; and not removing condensate from the pit within 24 hours. Some well sites received a couple of NOAVs during this time period.

In one of the COGCC NOAV reports, it was documented that a Barrett employee said he was unaware that he was violating a COGCC rule by filling the pit too full.<sup>40</sup>

### **Burning the Condensate**

One case, in particular, should be highlighted for its air quality issues. On or within a few days of December 24, 2005, condensate from a Barrett owned well was transported to the Werner 44A-23-692 well site and burned. According to COGCC rules, operators are not allowed to haul condensate from one pit to another for disposal purposes without a permit. Barrett had not obtained a permit to use the Werner site as a centralized location for waste disposal purposes. Barrett was issued a Notice of Alleged Violation for transporting the wastes to the Werner pit.

The burning of condensate created smoke that sparked complaints from nearby residents. Brian Macke, COGCC director, told the *Glenwood Springs Post Independent* (the Post) that burning condensate "does get rid of the odor problem quickly, which we thought was beneficial."<sup>41</sup> The Post also reported Garfield County environmental health manager as saying "I felt pretty good that there was no direct impacts to anybody in the area."<sup>42</sup>

Yet, despite the lack of concern on the part of the Garfield County staff, on December 29, the Air Pollution Control Division (APCD) of the Colorado Department of Public Health and Environment revoked the burning permits that it had issued to Barrett. According the Post, this was done after the APCD learned of complaints made to Garfield County about the pit fires.<sup>43</sup> There is no information on whether the state agencies or Garfield County conducted air quality monitoring during the burn operations.

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<sup>40</sup> COGCC NOAV Report. 12/12/2005. Document 200080875.

<sup>41</sup> Webb, D. 12/09/2006. "Tempers flare over Barrett pit fires." *Glenwood Springs Post Independent*.

<sup>42</sup> *ibid.*

<sup>43</sup> Gray, D. 01/04/06. "Fires not as bad as some report," *Glenwood Springs Post Independent*.