



COLORADO OIL AND GAS CONSERVATION COMMISSION

A STAFF REPORT TO THE COMMISSIONERS

“LESSONS LEARNED” IN THE FRONT RANGE FLOOD OF SEPTEMBER 2013

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Commission

EXECUTIVE SUMMARY

The Colorado Oil and Gas Conservation Commission (“COGCC” or the “Commission”) estimates that more than 5,900 oil and gas wells lie within 500 feet of a Colorado waterway that is substantial enough to be named. When these streams flood, nearby oil and gas facilities are at risk of damage, spills, environmental injury and lost production.

COGCC continues its work in the state’s recovery from the September 2013 flood along the Front Range of Colorado. COGCC has completed more than 3400 firsthand inspections of the oil and gas facilities affected by the flood. It has discussed flood observations and recommendations in detail with industry, other federal and state agencies, first responders and local governments, conservation groups and many others. The agency participates fully in Governor Hickenlooper’s broad flood response efforts started when the extraordinary rains began to fall.

COGCC has learned from these experiences, and this report is built upon that information. Section III collects and describes flood observations by COGCC staff and others. These observations range from highlighting significantly varying levels of protection offered by different anchoring systems to the importance of releasing to the public accurate and comprehensive COGCC information in the early days of the flood. Section IV assembles suggestions to improve Colorado’s oil and gas program – suggestions gathered from many sources by COGCC since the flood. These suggestions also vary widely, from those who believe COGCC regulations worked well to protect against the flood and should be left as they are today to those who believe that additional construction and other regulations are called for statewide as a result of the flood experience.

Section V contains COGCC's staff recommendations to the Commissioners for future action by COGCC. These recommendations are built upon the observations and suggestions collected by COGCC during its flood response.

COGCC staff suggests no statutory changes. It proposes for Commission consideration adopting additional "best management" approaches for oil and gas facilities located near Colorado waterways, including remote shut-in capability and certain construction requirements for wells and equipment. Finally, COGCC staff proposes several changes to COGCC policies and practices that would better prepare the agency for future emergencies.

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(October 21, 2013)

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2014

I. INTRODUCTION

The flood that struck the Front Range of Colorado in September 2013 was a major disaster and emergency. Damage to the oil and gas industry was significant, but it was only a part of the story of the flood.

Rainfall amounts were extraordinary. Storms persisted for days. Flood waters killed ten people and injured and left homeless many more. More than 18,000 people were evacuated from their communities. More than 1850 homes were destroyed. Water and debris caused great damage to roads, bridges, and land.

The State estimates the toll for this flood damage will reach more than \$3.35 billion. Communities will take years to recover.

Many oil and gas facilities located near flooded streams were damaged in the September 2013 flood. Oil, condensate and produced water spilled into the environment. Early on, there were widespread fears that public safety was threatened by damaged oil and gas equipment. Those fears later proved to be unfounded, but they attracted nationwide attention nevertheless.

This staff report analyzes and describes the “lessons learned” about Colorado’s oil and gas industry and the work of COGCC during and after the flood of September 2013. It describes how industry and COGCC might, in anticipation of the next flood or other emergency in Colorado, improve the armoring of oil and gas equipment against damage. It also describes how COGCC might improve its future emergency response operations.

COGCC estimates, using one available hydrologic database, that more than 20,850 oil and gas wells lie within 500 feet of a river, stream or other drainage in Colorado. COGCC

further estimates, using a different hydrologic database, that more than 5,900 oil and gas wells in Colorado lie within 500 feet of a waterway that is significant enough to be named.

Given COGCC's experience with oil and gas operations during the September 2013 flood, it is important to ask whether additional direction from the Commission is warranted with regard to some or all of these industrial facilities. That is a principal objective of this report.

Two fundamental COGCC missions are advanced by this report. First, it is written to assure that oil and gas activity in Colorado attains the highest standards in the Nation for protection of public health and safety, the environment, and wildlife. Second, it supports Colorado's oil and gas industry as it works after this emergency to return to full and efficient production of the State's oil and gas resources.

Section II of this report describes background information. Sections III and IV compile observations and suggestions collected by COGCC internally and from many interested parties with many different perspectives. Most significant for the Commission's future work, Section V contains COGCC's staff recommendations to the Commissioners for future actions concerning oil and gas facilities located near rivers, streams and other waterways throughout Colorado.

II. BACKGROUND

This report is based upon the "lessons learned" by COGCC during and after the flood of September 2013. It is an initial step toward a COGCC program that might better and more resiliently locate oil and gas equipment near drainages in Colorado. It is also a step toward improving COGCC's response to natural disasters that might imperil Colorado oil and gas facilities in the future.

This section describes background information that supports the observations and recommendations that follow.

A. Oil and gas facilities near drainages in Colorado

Many oil and gas facilities are located near the Front Range streams and waterways that flooded in September 2013. These include wellhead structures, well pads, tank batteries, separators, heater treaters and other important oil and gas production equipment.

COGCC's database of oil and gas locations identifies 1614 wells lying within the "flood impact zone" designated by COGCC during its flood response in October 2013. The flood impact zone is the area estimated by COGCC to be where flood waters actually flowed. If areas outside that zone are included, areas also affected by sustained and heavy precipitation, COGCC estimates that more than 2650 wells and associated facilities were affected directly and indirectly by the disaster.

COGCC has used its database of oil and gas locations to estimate how many Colorado oil and gas facilities potentially are imperiled during a flood. Using its geographic information system (GIS) and the United States Geological Survey's *National Hydrography Database*, COGCC estimates that, across Colorado, more than 20,850 oil and gas wells and facilities lie within 500 feet of a drainage. (Many of the drainages identified in this database ordinarily are dry. Nevertheless, they flow during precipitation events.) Using a second database that identifies named drainages in Colorado, obtained from the Colorado Geological Survey, COGCC estimates that more than 5,900 wells lie within 500 feet of a Colorado river, stream or other waterway that is substantial enough to be a named drainage.

Operators choose oil and gas locations near waterways in Colorado for a variety of reasons. One common circumstance reflects the split ownership of land that exists in many

parts of Colorado. In these situations, the surface of the land is owned by one person. A different person owns the underground estate, typically including oil and gas resources and the right to develop them.

When the owner of split estate oil and gas resources wishes to develop those resources, the surface owner and the mineral owner (or its lessee) must reach an accommodation. In Colorado, it is common for surface owners to use their land for farming and ranching. These surface owners often negotiate with oil and gas operators to locate their wells and production equipment and pads so as not to occupy surface that is valuable for agricultural development. As a result, oil and gas operators often place their pads and equipment at locations close to a waterway – locations where the land cannot otherwise be used for agriculture.

A second reason to locate oil and gas equipment near a stream is a regulatory one. Sometimes building setback requirements leave an operator with little practical choice other than to site their operations in undeveloped floodplains and away from occupied structures.

A third reason reflects Colorado's geographic diversity. In some parts of the state, topography – a general shortage of flat locations amid steep slopes – causes operators to locate wells and equipment near waterways. The Western Slope and the Raton and San Juan areas are notable examples of these areas.

B. Damage and spills in the September 2013 flood

The oil and gas industry suffered considerable damage in the September 2013 flood. Operators report to COGCC that 2658 wells were shut-in in anticipation of the flood waters. As of the date of this report, 89 percent of those wells – 2360 wells – have returned to

production. Reduced production of Colorado's oil and gas resource continues due to the flood.

The flood caused substantial and expensive damage to oil and gas tank batteries, production equipment and installations located near waterways.

Unfortunately, spills of oil and gas materials also occurred in the flood. Oil, condensate and produced water spilled into the environment from equipment hit by debris or upset by flood waters. About 1150 barrels (48,250 gallons) of oil and condensate spilled. More than 1035 barrels (43,478 gallons) of produced water also spilled. The largest single spill of oil or condensate was 323 barrels (13,566 gallons). The largest single spill of produced water was 125 barrels (5250 gallons).

All spills are undesirable. Nevertheless, Colorado was fortunate in the September 2013 event that oil and gas equipment sited near the flooded streams and waterways did not fare worse – and spill more. As just described, no single catastrophic spill – no single uncontrolled long-term release – occurred in this flood. Just as important, no single downstream location accumulated a large quantity of spilled oil, condensate or other oil and gas materials.

For the most part, spilled liquids from oil and gas operations washed away in the flood without leaving a trace behind. These spilled materials were greatly diluted by the flood waters. They are now undetectable. These facts are evident in samples taken after the flood in affected streams by the Colorado Department of Public Health and Environment and the United States Geological Survey. These facts are also evident in samples taken and data analyzed by operators after flood waters receded.

Unfortunately, the more favorable aspects of these outcomes are no sure predictor for oil and gas operations in a future flood in Colorado. The reasons for this conclusion include the fact, described in more detail below, that flood flows in September 2013, at many places important to oil and gas operations, did not approach historical peak flows recorded in previous floods. Nevertheless, it is important to acknowledge that the State of Colorado was fortunate with regard to the size and fate of the relatively small amounts of spilled oil and gas materials in the September 2013 flood.

C. COGCC's investigation

COGCC has closely examined how oil and gas facilities were affected in the flood in September 2013. As of the date of this report, COGCC has conducted more than 3400 individual flood-related inspections and evaluations. (“Inspections” are complete and fully recorded examinations of sites using COGCC inspection protocols. “Evaluations” are reconnaissance visits to individual flooded sites undertaken in the early days of the flood to assess conditions.)

From these many firsthand observations, COGCC has learned a great deal about what happened and how oil and gas equipment near streams was affected. This information informs every aspect of this report.

D. COGCC's October 21, 2013 recommendations for repair and reconstruction

COGCC released interim recommendations for better oil and gas practices near potential flood areas shortly after the September 2013 flood. Based upon its observations during and immediately after the flood, COGCC published *Recommended Practices for*

Flood Impact Zone Reconstruction on October 21, 2013. This document is Appendix A to this report.

The timing of this interim document is especially important from the perspective of “lessons learned.” It was released rapidly so as to advise operators who were already beginning to reengineer, reconstruct and relocate facilities damaged in the September 2013 flood.

COGCC’s October 21, 2013 document contains the following recommendations:

1. Secondary containment should be constructed with steel berms and lined with synthetic liner material bolted to the top of the steel berm.
2. Tanks should be constructed on compacted fill to reduce sub-grade failure.
3. Tanks should be ground-anchored, with engineered anchors and cabling routed through welded eyelets.
4. Buried and partially buried vessels should be ground anchored.
5. Structural fencing and barriers should be located at the upstream end of facilities and wellheads to deflect flood debris and heavy flood waters in order to reduce site damage.
6. Remote automated controls should be installed and used to monitor and shut-in wells to reduce the potential for fluid releases and prevent overflows where tanks are inaccessible for extended periods.
7. Production facilities should be aligned parallel to the general drainage or flow path. Construction perpendicular to the drainage or flow path should be avoided.

E. COGCC’s “lessons learned” workshop and ongoing industry efforts

COGCC held a public workshop to discuss “lessons learned” in the September 2013

flood. The workshop took place on February 6, 2014 in Denver and was well attended.

Presentations and other materials from this workshop are posted on the COGCC website.

COGCC Chairman Tom Compton moderated the workshop. Speakers with different backgrounds and experiences in the flood presented their views. They described for participants their suggestions for oil and gas operations located near waterways and their suggestions for other aspects of COGCC activities in emergencies. Presenters included first responders, a local fire chief, the oil and gas industry, and various federal, state and local officials who were involved directly in the flood emergency response in September 2013.

As described by Chairman Compton, the workshop was held to gather information for the Commission to use during the Commission's future determination of whether additional policies, rules, recommendations, or other authorities are needed for oil and gas operations located near waterways across Colorado.

Much of the discussion in this report – and many of the recommendations in this report – flow directly from the discussion at the workshop.

Views expressed at the workshop varied widely. In particular, some participants suggested that COGCC's rules worked well to minimize damage during the September 2013 flood and that no regulatory change is needed. Other participants stated the opposite view, that more substantial regulation is needed for oil and gas operations near streams in Colorado and that new regulation should apply statewide.

Recurring themes in the workshop included better communication, more robust relationships formed before the next emergency occurs, and the great usefulness of conveying information about oil and gas facilities early and accurately.

The agenda for the workshop is Appendix B to this report. COGCC took notes during the workshop discussion. Those notes are included as Appendix C.

Finally, COGCC is advised that the oil and gas industry in Colorado is carefully evaluating the “lessons learned” from the September 2013 flood, as well. Representatives from the Colorado Oil and Gas Association met with COGCC staff in November, 2013 to discuss these matters. They presented to COGCC many good ideas concerning “best management practices” that might be adopted for oil and gas equipment located near streams.

The Colorado Oil and Gas Association announced at the February 6, 2014 workshop that it expects to publish in the early part of 2014 its findings and recommendations concerning these best management practices. COGCC commends the Colorado Oil and Gas Association, and the Colorado oil and gas industry more generally, for these efforts.

III. OBSERVATIONS FROM THE FLOOD

This section collects observations from COGCC and others concerning oil and gas operations and the flood conditions during September 2013. These observations are assembled from many sources, including other state, federal and local agencies, first responders, the oil and gas industry, the conservation community and other individuals and entities interested in oil and gas operations in Colorado.

Most significant, COGCC has examined firsthand all the wells and associated equipment affected by the September 2013 flood waters. COGCC has inspected or evaluated every one of the 1614 wells located within COGCC’s designated flood impact zone. And COGCC has observed many additional wells outside the flood impact zone that were affected in some way by the rain and other flood conditions in September 2013. As described

above, at the time this report is written COGCC has completed more than 3400 separate inspections and evaluations of these wells and associated equipment.

A. Current COGCC regulatory requirements

This section describes COGCC's current regulatory requirements concerning flood plains.

1. COGCC's current regulations require oil and gas equipment in floodplains to be anchored. Rule 603.g. states:

603.g. Statewide equipment anchoring requirements. All equipment at drilling and production sites in geological hazard and floodplain areas shall be anchored to the extent necessary to resist flotation, collapse, lateral movement, or subsidence.

COGCC rules do not define a "floodplain area" or what it means to be "anchored."

2. COGCC's regulations require pits in floodplains to be reclaimed. Rule 1003.d. declares, in part:

d. Drilling pit closure. As part of interim reclamation, drilling pits shall be closed in the following manner:

(1) *Drilling pit closure on crop land and within 100-year floodplain.* On crop land or within the 100-year floodplain, water-based bentonitic drilling fluids, except *de minimis* amounts, shall be removed from the drilling pit and disposed of in accordance with the 900 Series rules. Operators shall ensure that soils meet the concentration levels of Table 910-1, above. Drilling pit reclamation, including the disposal of drilling fluids and cuttings, shall be performed in a manner so as to not result in the formation of an impermeable barrier. Any cuttings removed from the pit for drying shall be returned to the pit prior to backfilling, and no more than *de*

minimis amounts may be incorporated into the surface materials. After the drilling pit is sufficiently dry, the pit shall be backfilled. The backfilling of the drilling pit shall be done to return the soils to their original relative positions. Closing and reclamation of drilling pits shall occur no later than three (3) months after drilling and completion activities conclude.

3. Under current rules, chemical storage, staging areas and refueling areas must be located outside floodplains. Rule 1024. requires:

1204. OTHER GENERAL OPERATING REQUIREMENTS

a. The operating requirements identified below shall apply in all areas.

....

(4) Establish new staging, refueling, and chemical storage areas outside of riparian zones and floodplains.

B. COGCC's direct observations

This subsection describes COGCC's direct observations during and after the September 2013 flood.

1. Wellhead structures generally fared well during this flood. These are the vertical pipes and surface valves emerging from the ground at a well, also called the "Christmas Tree." Some inundated wellhead structures were protected by a substantial barricade that effectively deflected debris carried by flood waters.

COGCC knows of only one wellhead damaged significantly in the flood. There was no substantial spill or release from this damaged wellhead or other wellheads.

2. Very few oil and gas earthen pits exist generally within the broader area affected by the September 2013 flood and rains. No active earthen pits were identified by COGCC

within the “flood impact zone” created by COGCC to determine the boundaries to moving flood water in September 2013. COGCC is aware of no releases from earthen pits during this flood.

Other parts of the state are considerably different in this regard. On the Western Slope and in the Raton and San Juan areas, oil and gas earthen pits located near waterways are much more common.

3. Tanks, tank batteries and other production equipment fared less well during the flood event. Some tanks were toppled or dislodged by flood waters. Some production equipment, such as separators or heater treaters, were moved by flood waters.

4. Flowing water eroded earthen foundations beneath tanks and production equipment in many circumstances.

5. When tanks and other equipment were moved by flood waters, attached piping twisted, broke and sometimes leaked.

6. Tying down tanks and other equipment with cabling and anchors worked well to restrict movement when the cabling and anchors were robust and properly engineered and attached. Cabling and anchors did not work as well when the cabling was not connected directly to equipment, including situations where cable was simply draped over equipment. Light duty anchors used in some cabling systems were easily dislodged by flood waters and debris.

7. Heavy duty barricades located upstream of equipment effectively reduced debris damage to equipment and tanks.

8. Tanks and equipment generally aligned with flood flows sustained less damage than equipment aligned across flood flows.

9. Secondary containment comprising substantial metal berm walls, with heavy liners attached to the top of the metal berm walls, held up much better against flood and debris flow than earthen berms used as secondary containment. Earthen berms were substantially eroded by flood flows.

10. Damage to oil and gas equipment was caused by water rushing past, by impact from large debris carried in the flood flow, and by rising groundwater.

11. In localized areas, flood water flowed and moved in unexpected directions. Streams moved laterally and were rechanneled in many areas, sometimes to the benefit and sometimes to the detriment of oil and gas equipment.

12. In flooded areas, flows from nearby flooded ditches were sometimes as dangerous to oil and gas equipment as water flowing in stream channels. In several cases, ditches redirected flood waters significantly.

13. Residual water left many wells and facilities inaccessible after the moving flood waters receded. Some of these stranded wells remained inaccessible for days or even weeks.

14. Flood damage to the roads that lead to wells and facilities left the affected facilities inaccessible to COGCC and operators in some cases. Some of these wells and facilities were inaccessible in this way for days or weeks.

C. Stream flow and well inventories

1. No hydraulic fracturing operations were ongoing in the region flooded in September 2013. Two operators were staging equipment for hydraulic fracturing operations in the days prior to the flood, but the staged equipment was withdrawn from the area prior to the arrival of flood waters.

2. No drilling operations were significantly affected by the September 2013 flood.

Muddy roads stopped two cementing crews from working for a period of time.

3. In many areas affected by the September 2013 flood, the peak flow of flood water did not approach the magnitude of historical maximum flows experienced in previous floods. This is an important observation. Equipment that fared well in the September 2013 flood might not do as well in a flood of historic magnitude.

Two examples illustrate this observation. At the stream gage in Boulder Creek at Boulder, the peak flood flow in the September 2013 event was about 5,000 cubic feet per second. During the historic flood in 1894, however, the peak flow at the same spot set a still-standing record at about 11,000 cubic feet per second.

The gage in the South Platte River near Fort Morgan provides a second example. The September 2013 peak flow at this gage was about 50,600 cubic feet per second. The record peak flood flow at this spot occurred during the flood of 1935. It was about 83,700 cubic feet per second.

COGCC recognizes that, for future planning, this observation is more complex than simply comparing the height of water in different floods. A well inundated by water in September 2013 might simply be inundated by higher water in a larger flood – and suffer no additional damage. But a well that remained dry in September 2013 might not remain dry, and might be damaged, in a larger flood. Moreover, depending upon changing channel width and depth, the forces on wells and equipment exerted by a larger flood might or might not be greater than in the September flood. Finally, debris flows may differ significantly in different floods.

2. The relatively “lower” peak flows measured in September 2013 occurred despite record-setting rainfall amounts in some areas of the Front Range during the flood event. Timing is an important reason that explains this seeming disparity. Historic floods that led to much greater peak flood flows in the past occurred in the Spring and atop runoff. The Front Range floods of May and June, 1894 and May, 1969 are examples. In contrast, during the storm in September 2013 that took place in early Fall, rainfall flowing to streams did not add to underlying runoff flows.

4. The number of oil and gas wells and related equipment affected by the September 2013 flood is large. Within the flood impact zone delineated by COGCC – the areas near streams where COGCC estimates that flood waters actually flowed – there are 1614 wells. Within the broader area affected directly and more indirectly by flood waters and heavy precipitation, COGCC estimates that there are more than 2650 wells. COGCC does not have exact numbers for the production equipment and tanks associated with these wells, but there are many such locations in the flooded area.

5. As described in section II.A. above, thousands of oil and gas wells and associated equipment are located near drainages throughout Colorado. While COGCC’s estimates are not precise concerning these wells, the numbers nevertheless provide an order of magnitude as to the substantial numbers of wells and associated equipment in Colorado that might be subject to flooding at some point.

D. Why wells and equipment in Colorado are located near drainages

1. As described in more detail section II.A above, longstanding practical pressures exist to locate wells and associated oil and gas equipment and tanks near waterways in Colorado. Negotiations between surface owners and mineral rights owners lead to this result

when surface owners wish to locate oil and gas facilities on otherwise nonproductive lands. Setback requirements in Commission rules sometimes lead to locating facilities near waterways when other choices are not available. Finally, topography – steep slopes and otherwise limited areas for oil and gas locations –often lead to oil and gas locations close to waterways on the Western Slope and in San Juan and Raton regions.

E. The importance of remote shut-in capability

1. Remote shut-in capability for oil and gas wells is an important safety feature to protect the public. Wells shut-in during an emergency do not continue to release oil and gas and other materials if piping or other equipment is damaged. Inaccessible wells that are shut-in during an emergency do not threaten to overtop product or produced water tanks through continuing production.

In anticipation of the flood of September 2013, the great majority of the 2657 wells shut-in were shut-in by remote means. Had only manual means for shut-in been available, substantially fewer wells could have been shut-in before the flood waters arrived.

2. In the very early days when rain started to fall, oil and gas operators in the path of the impending flood of September 2013 completed a rapid task determining which of their wells were threatened and should be shut-in. Again, this was an important public safety protection for the citizens of Colorado.

COGCC understands that, as the rains first began to fall, operators undertook extraordinary efforts internally to assemble inventories of their wells that were threatened, and then to send remote signals (or crews) to shut in the wells. COGCC commends this accomplishment.

It would have been considerably easier for these operators to respond rapidly if they had had inventories assembled beforehand for their wells and equipment near streams.

3. COGCC is aware of a small number of wells threatened by the flood waters within COGCC's designated flood impact zone that were not shut-in by their operators. Five wells fall into this category. These wells are owned by three separate small operators. These wells do not have remote shut-in capability.

In this flood event, though some damage was sustained no spill occurred from these five wells. Nevertheless, COGCC believes that these wells posed a considerably greater threat to public health and the environment than the wells that were shut-in prior to the flood. Had any of these five wells been damaged significantly, hard-to-control spills likely would have occurred.

F. Other matters

1. Floods are not the only emergencies in Colorado that could require a COGCC response. Oil and gas facilities sometimes lie in the path of a wildfire. Blizzards sometimes isolate oil and gas operations from access for substantial periods of time.

2. When oil and gas facilities are involved in an emergency in Colorado, information transmitted by COGCC to the public takes on substantial and heightened importance. This collection and release of information is an important part of COGCC's duties in an emergency.

3. Oil and gas facilities sited upstream of water supply intakes pose a particular threat during flooding.

4. If COGCC is to address oil and gas facilities located near waterways in Colorado in some fashion, it must carefully decide how close to a waterway is “close enough” to pose a threat to oil and gas facilities from flooding.

Floodplain maps and floodplain delineations are useful to gain an idea concerning the paths flood waters might follow in the future. Nevertheless, these maps and delineations are imperfect predictors.

Various statistical measures for the frequency and magnitude of a flood – a “hundred-year flood,” for example – are commonly used indicators of where to expect water at some point. These measures are only imprecise estimates, however. They must be used carefully for regulatory or planning purposes – and only with an understanding of their significant limitations. *See, e.g.* Roger Pielke Jr., *Against the 100-year Flood*, Roger Pielke Jr.’s Blog, September 15, 2013, <http://rogerpielkejr.blogspot.com/2013/09/against-100-year-flood.html> (concise description of limitations of flood frequency predictions).

Peak historical flows in streams, when available, are an obvious and considerably more reliable indicator of how much water Colorado has actually experienced at a particular spot at some point in its history. These figures give perspective to how much peak water might be expected in the future in a reasonable worst-case circumstance. But they do not account for important changed circumstances that may exist on the ground, including altered streambeds and more recent development in flood plains.

5. Large operators and small operators have at their disposal vastly different resources to anticipate, react to, and deal with the aftermath of a disaster emergency. Small operators in particular may not have critical resources necessary to react rapidly and properly to spills during a future emergency.

IV. SUGGESTIONS FOR IMPROVEMENT GATHERED BY COGCC

This section of this report collects the suggestions gathered by COGCC in the wake of the September 2013 flood. COGCC believes it is valuable to record all these suggestions in one place. Thus, all suggestions heard by COGCC are collected in this section and set forth without COGCC's judgment about the merit of a particular suggestion. (Recommendations by COGCC staff to the Commission – recommendations built from the suggestions described in this section – are contained in Section V., the next section of this report.)

The suggestions below come from many sources. Some originate within COGCC and reflect internal staff discussions. Others come from the oil and gas industry. Still others come from first responders, the conservation community, other agencies of government at all levels, and other interested parties.

The list that follows is separated into four categories. The first contains suggestions concerning the location and construction of oil and gas facilities near drainages. The second contains suggestions addressed to aiding first responders. The third addresses matters internal to COGCC in order to prepare better for a future emergency. The fourth category collects miscellaneous suggestions.

We again underscore that widely divergent views have been heard by COGCC concerning the need for changes to the regulation of oil and gas facilities near streams in Colorado. Some believe that the experience of the September 2013 flood shows that COGCC's current rules and policies work well and do not need change. Others believe, based upon the same event, that formal regulatory change is needed and that new regulations should be applied statewide.

Finally, COGCC recognizes that the suggestions below do not differentiate based upon the disparate geographical areas of Colorado. COGCC nevertheless understands that local conditions may raise important considerations.

A. Location and construction of oil and gas facilities near drainages

1. Operators should avoid locating wells and production equipment and tanks near waterways whenever practical and possible.

2. Remote shut-in capability is a key aspect of oil and gas facility safety and environmental protection in an emergency. Absent shut-in, the well continues to flow and that flow could result in a spill if piping or production equipment is damaged. A shut-in well also eliminates the possibility of production overflow spills if a site is inaccessible during an emergency. Spills like those described may require urgent and dangerous response action in the midst of a broader emergency.

An operator's ability to shut-in wells remotely allows for safer, more rapid and more broad action by the operator in anticipation of an emergency like the September 2013 flood.

3. Operators should develop and update – routinely and well in advance of a flood emergency – inventories of wells and other facilities potentially threatened by flood waters. The fact that these inventories exist and can be used immediately in the too-brief and chaotic runup to a flood emergency will enable an operator to focus much more usefully upon appropriate preventative strategies.

4. Stout metal barriers or fencing should be installed just upstream of wells, tanks and other production equipment to deflect waterborne debris and heavy flood flows.

5. Solid metal berms – with sturdy synthetic liners attached to the top of the metal berms – should be used for secondary containment. Earthen berms should not be used for secondary containment.

6. Tanks, tank batteries and other production equipment should be located as far from waterways as practical.

7. Tanks and production equipment should be built on compacted soil in order to reduce sub-grade failure.

8. Tanks and production equipment should be placed upon pads constructed at a height above expected maximum flood stage when practical.

9. Tanks should be anchored to the ground using engineered and stout cables and anchors. Cabling should run through welded eyelets on metal tanks and through molded or other securely attached eyelets on tanks constructed of plastics or other materials.

10. All buried and partially buried tanks should be anchored to the ground with engineered anchors.

11. Align oil and gas facilities parallel to expected flow path during a flood, and avoid construction of production facilities perpendicular to expected flow path.

12. Minimize chemicals located at well and production sites at any time. Know where any and all chemicals are located so they can be removed prior to flooding.

13. Valves and piping should be engineered to “break closed” or “break shut” when possible.

14. Piping should incorporate engineered flexibility and resiliency in order to minimize or avoid breaking when equipment is twisted or moved.

15. To avoid overtopping of storage vessels, operators should plan for ongoing well production in the absence of lease road access. When the lease road is left impassible, how will the operator gain needed access to remove product and waste?

16. Some commenters suggested in discussion that setback restrictions should be adopted for wells and facilities near streams.

17. Operators should create internal emergency plans for flood, wildfire and other potential disasters.

18. Are new requirements for wells and other facilities near waterways, if any, to be applied retroactively? Are those requirements to be applied only to new construction?

19. How can COGCC assist operators to return to production most safely and rapidly in the wake of a flood or other type of emergency? *See* COGCC's Notice to Operators dated October 4, 2013, concerning restart of operations, and COGCC's and Colorado Parks & Wildlife's temporary waiver of construction restrictions near bald eagle nesting sites contained in a memorandum from Steve Yamashita (Colorado Parks & Wildlife) to Matt Lepore (COGCC) dated October 11, 2014. Both documents are posted on the COGCC flood response web page.

B. First responders

1. Signage at oil and gas facilities is especially important for first responders. They need information quickly about the nature of the site, the site operator, who to contact, and how to make contact.

When an emergency keeps first responders a substantial distance away from a facility, current signage required by COGCC may be located within a "zone of danger" around the facility, and first responders may be too far away to read the sign. COGCC heard an example

where the danger from vapors released by a damaged oil and gas facility kept first responders so far back that they were unable to determine important facility information quickly.

Is there a way to identify oil and gas facilities more surely for first responders?

2. In the early days of the September 2013 flood, some local first responders lost internet access. At the same time, important mapping and other information is published by COGCC on its website and made available to first responders and others over the internet. First responders suggested to COGCC that emergency personnel in local communities would benefit from updated physical maps showing the location and identity of local oil and gas facilities.

COGCC is exploring the possibility of using thumb drives to send to local emergency response authorities local maps and detailed oil and gas information that might be needed in an emergency. This information could be used to assist first responders without internet access. The thumb drives could be updated by COGCC yearly or, perhaps, more often.

3. COGCC inspectors, engineers and environmental specialists have substantial expertise in the safety and environmental aspects of oil and gas facilities. These COGCC personnel also have immediate access, through their computers equipped with cellular connections, to vast amounts of oil and gas information available quickly from COGCC databases. These COGCC personnel are present and available in all parts of Colorado that support significant oil and gas development.

COGCC could form closer and more direct relationships with local and state emergency response personnel in order to prepare for emergencies involving oil and gas operations. During an emergency response, local COGCC personnel with expertise could be

stationed at emergency response centers to allow state and local emergency response authorities to use the information available to COGCC.

4. Similarly, COGCC could make all of its expertise immediately available to state emergency response officials by stationing an employee at the state emergency response center during an emergency that involves both oil and gas facilities and a mobilization of the state emergency response center.

C. Internal COGCC improvements

1. COGCC can require “Incident Command System” certification and training for selected staff within COGCC. The Incident Command System is the standardized, on-scene, all-hazards emergency response framework used in Colorado and throughout the United States for all significant emergencies. It is a system of command structure, communications protocols, and other standardized approaches that promotes effective and coordinated emergency response.

This training and certification would help the trained COGCC officials to participate in emergency response anywhere in Colorado – and in ways that most benefit the broader emergency response organization in charge. Perhaps senior managers, field supervisors and selected field personnel across the state could be selected for this role. For these officials, up-to-date training and certification would be a job requirement. COGCC officials would also participate in appropriate training exercises with Colorado emergency response officials.

The Federal Emergency Management Agency, FEMA, offers many online self-study and self-certification courses available for no charge. In conjunction with Colorado emergency response officials, COGCC could select an appropriate menu of these courses for its own emergency response training and certification requirements.

2. COGCC can form closer relationships with State emergency response personnel and with local emergency response personnel in areas of Colorado with significant oil and gas development. These existing relationships are particularly valuable when an unexpected emergency looms. The formation and maintenance of these relationships would be a job requirement for appropriate personnel within COGCC.

3. COGCC's principal role in a flood emergency is to understand the oil and gas situation on the ground as soon as possible and then to provide expert information to emergency authorities and the public. It is essential that COGCC obtain firsthand and detailed knowledge and information about the state of affairs with regard to oil and gas operations affected by the emergency.

Often the safest and most comprehensive way to gain the firsthand information needed by COGCC is to have a COGCC official undertake a helicopter reconnaissance of the affected area. These reconnaissance flights commonly are arranged and coordinated through the Incident Command Center set up for the emergency.

COGCC should act now to work with State emergency officials to make sure COGCC is offered a spot on initial reconnaissance flights for experts when an emergency arises and oil and gas resources are involved.

4. The United States Bureau of Land Management wants to work with COGCC in emergency situations. COGCC could strengthen those relationships with BLM.

5. The United States Environmental Protection Agency wants to work with COGCC in emergency situations in the future. COGCC could strengthen those relationships with EPA.

6. COGCC can develop an emergency response manual for COGCC internal use.

This manual would be brief and straightforward. It would be designed to be available immediately and usefully when an emergency looms. It would not be a report left to sit on a shelf and be forgotten. It would be used in periodic COGCC emergency training.

The manual might contain:

- Names and contact numbers for emergency response officials in State offices, county offices, and in appropriate federal agencies.
- A checklist developed to organize emergency COGCC fieldwork. This checklist would guide COGCC approaches in the chaotic early days of an emergency. It would help COGCC quickly to think through what it needs on the ground and how to accomplish its goals.
- A checklist for safety concerns for COGCC personnel in an emergency. What inoculations should be required? What personal protective gear should be used? What decontamination instructions are needed to assure personal and family safety when COGCC workers return home after spending the day in a contaminated area?
- A checklist for safety concerns for first responders and citizens near oil and gas equipment in an emergency. This would be similar to public notices created by COGCC in the days after the September 2013 flood.
- A checklist for coordination with oil and gas operators affected by the emergency.
- A checklist for safe startup procedures after the emergency has passed.
- Checklists, as appropriate, with particularized considerations for floods, wildfires and blizzards.

- Printouts of especially useful information and URLs from, for example, CDPHE's excellent emergency information website.

- Brief descriptions for how to organize and use COGCC databases to hold information during the emergency. These empty databases would be set up as empty templates in COGCC's system in conjunction with the emergency manual. These database preparations would avoid the need first to use cumbersome written spreadsheets and then to incorporate the same information later into the COGCC database. The latter experience occurred in the September 2013 flood.

7. COGCC would conduct tabletop emergency training once per year among senior staff. COGCC would consult with State emergency response officials in order to make these training exercises as useful as possible.

8. COGCC plays an important role supporting the rapid restart of oil and gas facilities when an emergency situation finally allows. It is important for COGCC to evaluate its requirements at such a time in order to remove unnecessary impediments to restarting facilities safely and in a manner protective of the environment.

9. COGCC can take steps now to identify resources potentially in jeopardy due to a flooding event. For example, it can identify pits located near drainages across the state and act now to reduce damage caused by flooding in the future.

10. Do small operators present issues different from larger operators with greater resources in an emergency situation? Can COGCC support small operators in effective ways?

11. COGCC is told that newer and more modern GIS software might allow a faster and more comprehensive COGCC response in future emergencies.

D. Other matters

1. The United States Bureau of Land Management has announced that it will consider regulatory improvements for oil and gas facilities located near streams as it revises its Front Range Resource Management Plan.

2. An emergency that causes damage to many wells necessarily calls for an economic assessment by operators in the wake of the emergency. Operators will assess whether repairs and restarts are economically justified for wells that are marginal producers, for example. It is likely – as has happened after the September 2013 flood – that some wells will be plugged and abandoned after the emergency that would have continued in production had the emergency and consequent damage not occurred.

V. COGCC STAFF RECOMMENDATIONS TO THE COMMISSIONERS

COGCC has formed a set of staff recommendations to the Commission for oil and gas facilities located near waterways throughout Colorado. These recommendations are based upon the information contained in this report. They are described in this section.

A. Recommended statutory changes

COGCC staff does not recommend statutory changes.

B. Recommended changes to regulations

COGCC staff recommends the Commission consider changes to COGCC regulations. The following descriptions explain ideas supported by COGCC staff. (These descriptions are not presented in regulatory language.)

1. Each operator in Colorado should maintain current inventories of its wells and production equipment located near waterways. The inventory should be designed to allow the operator quickly to determine its wells and production equipment that might be in danger during a flood in a particular location.

2. All wells located within a designated distance from the ordinary high water mark of a waterway in Colorado should be equipped with remote shut-in equipment. This requirement should apply to all new construction. Existing wells should be retrofitted on a reasonable and practical schedule.

3. COGCC should evaluate the desirability of requiring remote shut-in capability requirements for wells in areas susceptible to wildfires. This idea would necessarily include an evaluation of how to determine the areas in Colorado most susceptible to wildfire.

4. No pit should be allowed within a designated distance from the ordinary high water mark of a waterway in Colorado. Any existing pit within these areas near waterways should be removed and reclaimed.

This recommendation has implications for operations on the Western Slope and in the Raton and San Juan areas. Pits are often located near streams in those areas because those locations offer flat land available among steep slopes. This is a matter for further discussion during the development of a regulation.

5. Tanks, tank batteries and production equipment should be located as far from waterways as possible and practical in individual circumstances. “Practicality” should balance the needs of surface owners, operators and topography.

6. The recommendations of COGCC in its October 21, 2013 publication should be included in regulations and apply within a designated distance from the ordinary high water mark of all waterways in Colorado. These requirements would be prospective.

- Secondary containment cannot be constructed of earthen materials. Rather, secondary containment must be constructed with steel berms and lined with synthetic liner material bolted to the top of the steel berms.

- Tanks and equipment must be supported upon compacted fill.

- Tanks and equipment must be anchored to the ground with anchors and cables. Anchors must be engineered appropriately and cables must be routed through eyelets welded to steel tanks or molded or otherwise attached to tanks constructed of other materials.

- All buried and partially buried vessels must be anchored to the ground using engineered anchors and eyelets welded to steel tanks or molded or otherwise attached to tanks constructed of other materials.

- Structural fencing and barriers must be located at the upstream end of production facilities.

- Production facilities must be aligned and constructed generally parallel to the expected flow path of high water.

C. Recommended changes to COGCC policies and practices

COGCC staff recommends the following changes to COGCC policies and practices.

1. COGCC should support ongoing efforts by the oil and gas industry and others to develop and implement best management practices for oil and gas facilities located near streams in Colorado.

2. COGCC should create an emergency response manual that will guide its activities in the early days of future emergencies. The manual should be simple, straightforward and easily and quickly available to staff – so it is helpful and usable immediately in the early and typically chaotic period of an emergency. It should contain checklists and descriptions that will assist staff to respond quickly, safely and effectively. It should contain copies of notices and documents used in previous events, so they can be used as models. The emergency manual should include the contents described in subsection IV.C.6. above.

3. COGCC should establish appropriate emergency templates in its database to enable rapid emergency recordkeeping in a practical and useful way.

4. COGCC should establish and maintain permanent relationships with Colorado's state emergency response authorities, including Colorado's Division of Homeland Security & Emergency Management. These relationships must be maintained by COGCC over long periods of time when no emergency takes place in Colorado. COGCC would, as a result, be much better prepared to assist in the next emergency that affects oil and gas operations.

5. As part of its long term relationship with Colorado's state emergency authorities, COGCC should emphasize its need for early reconnaissance (usually by helicopter) when an emergency includes significant oil and gas operations.

6. Similarly, COGCC should establish permanent relationships with Colorado's county emergency authorities in counties that contain significant oil and gas operations. These relationships, too, must be maintained by COGCC over long periods of time when no emergency takes place in Colorado. COGCC will, as a result, be much better prepared to assist in the next emergency that affects oil and gas operations in a particular county.

7. In conjunction with substantial consultation with state and federal emergency response professionals, COGCC should establish policies for the proper training of its personnel in emergency response. Current online FEMA training and certification should be required – in job descriptions – for appropriate COGCC personnel.

8. COGCC staff, including appropriate senior staff, should participate in tabletop emergency response exercises once per year. The design of these exercises should be based in part upon consultation with state emergency response officials.

9. COGCC requests for information from operators during and following an emergency can be better coordinated and made more efficient for operators and for COGCC. COGCC should always have only one internal point of contact for information submittals, and that individual should be clearly identified in all documents, in order to ensure rapid receipt and use of submitted information. COGCC should specify the information and updates it needs – but COGCC should minimize that information to the extent it can, and it should minimize the number of times operators must update their information. It is critical that COGCC receive emergency information from operators in a form that can be inserted rapidly and easily into COGCC's database – and COGCC must make its submittal requirements clear and easily understood by operators in this regard.

VI. CONCLUSION

The State of Colorado, COGCC, operators and others have learned valuable lessons from experiences in September 2013 flood along the Front Range of Colorado. This report is a step along COGCC's path to improvement in future emergency responses associated with oil and gas operations.

The descriptions and recommendations in this report will be discussed further among the Commissioners and all interested parties.

Matthew Lepore
Director, Colorado Oil and Gas Conservation
Commission

March 14, 2014

Appendix A

COGCC, *Recommended Practices for Flood Impact Zone Reconstruction* (October 21, 2013)

Recommended Practices For Flood Impact Zone Reconstruction

October 21, 2013

The disastrous floods in eastern Colorado in early September, 2013 caused significant damage to many of the oil and gas facilities that lay in the path of flood waters. Inspections and observations by the Colorado Oil and Gas Conservation Commission show that certain construction and location techniques within the flood impact zone fared better under the influence of flood waters, with significantly less damage, than other methods of construction and location.

Operators in the flood impact zone are reengineering, reconstructing and relocating facilities and equipment damaged in the floods. The purpose of this Recommended Practice is to encourage operators to adopt the following practices both during reconstruction and relocation as they undertake repair work in the flood impact zone, and for constructing new wells and production facilities located in any flood plain.

COGCC staff notes that armored secondary containment, structural tank restraints, upstream structural fencing, remote shut-in controls, and equipment alignment that locates tanks along streamlines, are best practices that can reduce damage in future floods.

COGCC recommends:

1. Secondary containment should be constructed with steel berms and lined with synthetic liner material bolted to the top of the steel berm.
2. Tanks should be constructed on compacted structure fill to reduce sub-grade failure.
3. Tanks should be ground-anchored, with engineered anchors and cabling routed through welded eyelets.
4. Buried and partially buried vessels should be ground anchored.
5. Structural fencing and barriers should be located at the upstream end of facilities and wellheads to deflect flood debris and heavy flood waters to reduce site damage.
6. Remote automated controls should be installed and used to monitor and shut-in wells to reduce the potential for fluid releases and prevent overflow situations where tanks are not accessible for extended periods.
7. Production facilities should be aligned parallel to the general drainage or flow path and construction perpendicular to the drainage or flow path should be avoided.

COGCC is advised that operators repairing and relocating equipment are discussing these and other best practices in various industry organizations. COGCC welcomes and strongly encourages this practice and welcomes input on these or other recommended practices for construction in flood plains.

COGCC requests that operators now reconstructing and relocating sites, as well as those constructing new wells or production facilities in flood plains adopt these and other recommended practices in order to reduce and mitigate damage and impacts during future floods.

Appendix B

Agenda – “Lessons learned” workshop on February 6, 2014



COLORADO OIL AND GAS CONSERVATION COMMISSION WORKSHOP

“LESSONS LEARNED” IN THE COLORADO FLOODS OF SEPTEMBER 2013

February 6, 2014

AGENDA

1. WELCOME AND INTRODUCTIONS

Mike King, Executive Director, Colorado Department of Natural Resources
Matt Lepore, Director, Colorado Oil and Gas Conservation Commission
Tom Compton, Chairman, Colorado Oil and Gas Conservation Commission

2. “LESSONS LEARNED” PRESENTATIONS

- A. A brief scientific perspective about the September 2013 floods – Robert Kimbrough, Assistant Director, Hydrologic Data, Colorado Water Science Center, USGS
- B. COGCC staff – Mike Leonard, South Region Field Inspection Supervisor
- C. U.S. Bureau of Land Management – Tom Heinlein, Front Range District Manager
- D. U.S. Environmental Protection Agency – David Ostrander, Director, Emergency Response and Preparedness Program, Region 8
- E. Colorado Office of Emergency Management – Chad Ray, Operations Manager, Colorado Office of Emergency Management
- F. The Oil and Gas Industry – Tisha Schuller, President and Chief Executive Officer, Colorado Oil & Gas Association
- G. Local Government – Ron Bateman, Fire Chief, Milliken and Johnstown Fire Protection Districts
- H. The Conservation Community – Laura Belanger, Water Resources and Environmental Engineer, Western Resource Advocates

3. OPEN DISCUSSION

4. Closing Remarks – COGCC Chairman Compton

Appendix C

Notes taken by COGCC during the “lessons learned” workshop of February 6, 2014

**Colorado Oil and Gas Conservation Commission
“Lessons Learned” Flood Response Workshop
February 6, 2014**

INTRODUCTORY COMMENTS

- Today marks an important milestone with COGCC to learn from the September 2013 floods to minimize impacts from floods in the future.
- The floods have impacted many agencies and constituencies.
- COGCC staff across the state were immediately pulled in and the Commission is still dedicated to remedying the effects of the floods.
- We want to learn from our successes and mistakes. It will help the Commission balance its statutory directives – protect public health and environment and support oil and gas development.

PANEL PRESENTATIONS

I. Robert Kimbrough, Assistant Director, Colorado Water Science Center USGS:

Historic Flooding in Colorado September 2013

- a. Low pressure over the western basin was the engine that drew the large amount of water in Colorado.
- b. Rainfall
 - i. Total precipitation September 8-15, 2013 – S. Platte River basin, areas with 18+ inches of rain (Boulder Creek Basin, St. Vrain Creek).
 - ii. Event was rare for: 1) extent, 2) rainfall duration, and 3) rainfall totals.
 - iii. New records for 1-day (9.08”), monthly (18.16”), annual (34.1”) at City of Boulder COOP station.
- c. Hydrographs and moving through the major basins affected: Streamgages, timing and magnitude of flows, what we don’t know.
 - i. Bear Creek Res. – peak of 1,800 ft³/s.
 - ii. Sand Creek – peak of 14,000 ft³/s, higher in 1950s and 60s.
 - iii. Boulder Creek – peak of 4,600 ft³/s at mouth. But flow of the tributaries combined in lower reaches (15,800 ft³/s).
 - iv. St. Vrain Creek – peak of 4,000 ft³/s, but 3 peaks converged. None of the stations were able to report the flows in their entirety.
 - v. Big Thompson – 16,000-18,000 ft³/s. Huge amount of sediment transported. More than 1300 landslides during the floods.
 - vi. Cache La Poudre River – peak of 8,000 ft³/s.
 - vii. Lower S. Platte – peak of 11,000 ft³/s. Fort Morgan gage – 60,000 ft³/s. Flood levels remained high days after the event (unusual).
- d. CONCLUSION: Flows weren’t as dramatic as thought in some basins, but were very significant in others with record flows.

II. Mike Leonard, South Region Field Inspector, COGCC:

- a. Background of the event

- i. Immediately started planning response. Received information from operators, helicopter surveys, and communicating with other agencies.
 - ii. 3,190 inspections and continue to monitor clean-up.
 - iii. No hydraulic stimulation operations were affected. Other than getting casing crews in no drilling operations were affected.
 - iv. Extensive media attention on oil and gas operations. Staff had to devote resources to respond to some complaints that were unfounded.
- b. Observations
 - i. Wellheads weren't significantly damaged by water or debris – manual or remote shutin prevented significant releases.
 - ii. Tank batteries had significant damage.
 - iii. Steel secondary containment protected tank batteries better than earthen berms.
 - iv. COGCC Rule 603.g. anchoring requirements prevented equipment displacement
 - v. Erosion and undercutting occurred where rivers changed flow – compromised access to locations.
- c. Best Management Practices
 - i. Operators should evaluate their operations in flood prone areas.
 - ii. Steel containment with liners are best.
 - iii. Facilities should be built on compacted fill.
 - iv. All tanks should be anchored with engineered anchors.
 - v. Barriers upstream of the equipment.
 - vi. Construct facilities to align with streamflow.
 - vii. Remote shutin capability.
 - viii. Locate away from flood prone areas.
 - ix. Maintain onsite chemicals at lowest possible volume and be prepared to move quickly.
 - x. Study historical events.
 - xi. Plan for road damage.
 - xii. Identify wells that could be threaten and prioritization plan.
- d. COGCC Internal Agency Response Lessons
 - i. Notices to the public.
 - ii. Develop information gathering and data analysis for more timely dispatch of field teams.
 - iii. Develop communication streams with various entities.
 - iv. Staff also needs to study historical events.
 - v. Staff Training at Incident Command System.
 - vi. Need to know who to call for helicopters, maps, and other help.

III. Tom Heinlein, Front Range District Manager, BLM

- a. BLM Lands we manage in these areas were not impacted greatly.
 - i. Limited federal surface ownership in NW Colorado (owns mineral estate, but other agency or private surface ownership).

- ii. Chance in the location of the oil and gas locations.
 - b. Healthy state and federal relationship demonstrated in flood response. BLM made oil and gas staff available, but they were not needed. Ongoing communication.
 - c. BLM remains supportive about how the flood response was handled and oil and gas regulation here in general.
 - d. Looking to the Future:
 - i. BLM is about to update Resource Management Plan encompassing flood area – will be help in that planning process. Will begin scoping later this year.
 - ii. BLM incident management program expanded relationship with FEMA – positive for preparation for future natural disasters.
- IV. David Ostrander, Director Emergency Response and Preparedness Program, EPA Region 8**
- a. EPA Authority for Oil and Gas production facilities (outside of disaster events):
 - i. CWA, spill reporting.
 - ii. Oil Pollution Act, spill prevention.
 - b. Disaster – EPA works with FEMA to provide support as requested.
 - i. Provided communication with FEMA, State Emergency Management, and COGCC. Clear about whom was doing what.
 - ii. Mission assignment to do aerial reconnaissance. Looking for significant ongoing spills. Aerial photos GPS located.
 - iii. Followed up on 3 reports to the National Response Center – on the ground surveys.
 - c. COGCC was the lead for response on the production facilities working with oil and gas companies. There were no significant discharges found by the EPA.
 - d. Recovering spilled oil is extremely difficult in flood situations – can’t use trucks or boats.
 - e. Lessons learned: Getting to know the good people at the Commission.
- V. Chad Ray, Operations Manager, Colorado Office of Emergency Management**
- a. More rescue missions than Hurricane Katrina. For 2 weeks were at 24/7 operations.
 - b. Colorado Office of Emergency Management – Coordinates agencies during disasters:
 - i. Consequence management.
 - ii. Resource management – helicopters, personnel, etc.
 - iii. Situational awareness – “common operating picture.”
 - c. Lessons learned:
 - i. We are here to build a relationship before it happens again - connect field managers.
 - ii. More than just floods – any disaster (fire impacting oil and gas wells).
 - iii. More than just water – Key infrastructure resources.
 - iv. COGCC and Emergency Management worked together to communicate with the public to tell people what was happening and what we were doing about it.
 - d. Appreciate ongoing communication that has occurred since the initial response.
- VI. Tisha Schuller, President and CEO, Colorado Oil and Gas Association**
- a. The floods were very personal and impacted lives of people and our community.

- b. Disparate emphasis placed on oil and gas industry with the amount of infrastructure (roads, bridges, and homes) that were destroyed.
- c. Before the flooding – oil and gas industry prepare for emergencies all the time.
 - i. Emergency Response Plans.
 - ii. Do drills.
 - iii. We do this every day.
- d. Flood Warning – don't know where the flooding is going to happen.
 - i. Evacuate drill sites.
 - ii. Remove on-site equipment.
 - iii. Monitor situation.
 - iv. Begin shut-in.
 - v. Set up command center.
- e. Floods Hit – on site and local communities.
 - i. Shut-in upstream and midstream facilities.
 - ii. Deploy personnel in the fields.
 - iii. Report updates to local governments, emergency responders, COGCC.
 - iv. Use vehicles, helicopters, and boats to help access locations.
 - v. Brought food, water, toilets. Raised \$2.3 million for the Red Cross.
- f. Address Incidents – relatively minor, but didn't get any kind of "pass."
 - i. Investigated all concerns.
 - ii. Report all incidents to local government, national command, EPA, COGCC < CDPHE. CDPHE tested water for oil and gas contaminants.
 - iii. Regular rigor and provided multiple daily updates.
- g. Stats: 20,000 wells in flood area, 1900 of those were shut-in, 13 total releases – surface tank releases (43,134 gallons). Compare to 220 million gallons of sewage released.
- h. Biggest challenge: Correcting misinformation about "catastrophic" oil and gas spills.
- i. Lessons Learned for operators: Next quarter of 2014 will provide a report to COGCC on what operators learned from the floods.

VII. Ron Bateman, Fire Chief, Milliken and Johnstown Fire Protection Districts

- a. Initial focus was on St. Vrain and S. Platte, but real issue were the Thompson drainages.
- b. "Leaning Tank Battery" Emergency Calls, but inaccessible. Difficult to know from the air whether it was oil or other waste.
- c. Lessons Learned:
 - i. Contact information on the well needs to be further removed from the hazard zone.
 - ii. Getting COGCC, industry, etc. representative there in a timely fashion. COGCC representative at County EOC prior to the incident.
 - iii. Training, especially for volunteers.
 - iv. Access to maps earlier. Hard copies of maps as well because computers went down.

VIII. Laura Belanger, Water Resources and Environmental Engineer, Western Resource Advocates

- a. High level of public concern about oil and gas facilities and appropriate level of response and updates.
- b. Important that state agencies have first-hand knowledge so not coming directly from industry (e.g. COGA).
- c. Transparency is very important – a little bit of disconnect between data collected and availability. Some high-level summaries were available, but no sediment data or formal review.
- d. Lessons learned:
 - i. Very unusual widespread flooding, so high dilution flows.
 - ii. Few open pits in flood area, but what if happened on the West Slope?
 - iii. Flood events are to be expected and may recur more frequently in the future.
 - iv. Contingency plans, especially upstream operators.
 - v. Everybody needs to be adhering to these standards – both large and small operators → Need to be integrated into the Rules.
 - vi. Applying BMPs to new facilities, but also retrofitting existing facilities.
- e. Risks to surface waters from emergencies and regular operations:
 - i. A lot of spills/releases located near surface waters.
 - ii. COGCC stream rules:
 - 1. Specific protections to streams through COGCC rules – near drinking water intake and areas supplying drinking water. Restricted surface occupancy areas – habitat and wildlife.
 - 2. But very small percentage of the waters in the state.
 - 3. Conditions in permits possible, but the protections are not required.
 - iii. Stream setback issue - opportune time to kick off stream setback rulemaking. It was unaddressed in the 2008 rulemaking but the Commission stated that it needed further development.

QUESTIONS/DISCUSSION

Commissioner Compton – Want to see where there's agreement/disagreement and help Commission prioritize. There will be another chance to make comments at a future Commission hearing.

- I. **Boulder City Council, Macon Crowles – GPS maps updated as wells get shut-in and flood impacted land, what were the software tools available to help coordinate these agencies?**
 - a. There are powerful tools available today. People should be able to look at an updated map and know who to contact – let the public and industry communicate better. Shortcoming of those tools.
 - b. RESPONSE (Director Lepore): One of the most valuable things we acquired early were EPA's aerial and GPS images. Those were built into COGCC's COGIS system – could look at where the water was and how many wells were in that area. It is a good idea to look at the continued use of maps and more sophisticated maps.
 - c. RESPONSE (Jim Milne, COGIS developer): During this event there were a lot of things going on with the maps – both hard and electronic. All of the information we had would go into our GIS database. We also used our interactive map, which made it available to

people who aren't GIS experts – could see where well was located and if it was flooded. There are some things we were doing internally that should've been available to a wider audience – will have to be a centralized map and increased coordination, but is possible with existing technology.

II. Bill Dvorak, Dvorak Expeditions and National Wildlife Federation – BMPs need to be enforceable and not just guidelines. We should initiate a formal rulemaking on the stream setbacks.

III. Barbara Kirkmeyer, Weld County Commissioner – Concerned about stream setback rulemakings. The Rules currently in place work. Fact that minor amount of oil and gas spilled.

- a. Doesn't mean we shouldn't look at spill containment. Anchoring is a Rule. May need to go and retrofit old tanks. Weld county emergency operations – county meets monthly with oil and gas operators.
- b. Oil and gas rep at the County EOC – in Weld County there was one, who was in contact with state EOC, Director Lepore specifically reached out to the County. Direct contact with the oil and gas companies.
- c. We have a County Emergency Response Plan and it worked really well.
- d. Biggest health concern was E. coli, not oil and gas! CDPHE working on waste treatment rules?
- e. Problem with looking at historical data – rivers moved dramatically and may never move there again → difficult to use to change drilling plans.

IV. Cathy Shull, Executive Director for Progressive 15. The spills were really low. Huge infrastructure damage but no well damage in my county. Differences in production facilities according to topography. No need for wholesale change in the rules.

CLOSING REMARKS

Commissioner Compton – There will be another flood. One thing I heard consistently from everyone was the need for communication. We need to know who the players are and develop a working relationship with those players before disasters occur. The Commission will have a hearing in the future to discuss the changes we need to make.