

After Action Review
Department of Environmental Protection (DEP) Incident Response
Chevron Appalachia LLC - Lanco 7H Well Fire
Dunkard Township, Greene County

This report provides an After Action Review (AAR) of the Chevron Appalachia LLC Lanco 7H well fire incident. This well fire incident occurred from February 11, 2014 through March 3, 2014.

DEP Oil & Gas Program (O&G) staff participating in the AAR include:

- John W. Ryder, Director District Oil & Gas Operations (DOGO) (by conference call)
- Alan Eichler, O&G Program Manager – DEP Southwest Region – Pittsburgh – (SWR)
- Scott Sabocheck, O&G Inspector Supervisor- O&G and ERT– SWR
- Edward Ritzer, O&G Inspector Supervisor– SWR
- John Carson, O&G Water Quality Specialist Supervisor – O&G and ERT– SWR
- Ben Dillie, Water Quality Specialist - SWR
- Bill Keefer, Water Quality Specialist - SWR
- Susan Banks, O&G Inspector - SWR
- Dan Orrahood, O&G Inspector- SWR
- Joe Steele, O&G Inspector – SWR

This AAR contains four sections:

1. Summary of the Incident and Chronology of Events
2. Problems Encountered
3. Lessons Learned from the Response
4. Recommendations to Prevent Future Incidents

1. Summary of the Incident and Chronology of Events:

On Tuesday February 11, 2014 at approximately 0645, employees of Cameron International, a Chevron Appalachia LLC (Chevron) contractor, were preparing for a safety briefing at the Lanco well pad (Lanco A Pad) in Dunkard Township, Greene County. Two employees walked toward the 7H well head, which was covered with tarps, to investigate a hissing sound. As they approached the well, natural gas leaking from the 7H well head under high pressure ignited. In the opening seconds of the fire, one of the two employees was injured and the other disappeared from view. When employees assembled at the rally point, they realized that there was one person missing¹. At approximately 0710, Chevron contacted Wild Well Control and requested their response to the incident. DEP staff began to arrive at the incident site at roughly 0830. Wild Well Control arrived at Chevron's Moon Twp. office at approximately 1200 and at the well pad site at 1810.

¹ The missing worker remained unaccounted for until February 26, when remains were located. The Greene County Coroner and the Pa. State Police conducted a search for additional human remains at Lanco A Pad on March 4, 2014.

On February 14, it was reported that the adjacent well head, Lanco 6H, began burning. At the time it was presumed that the intense heat and fire from the 7H well may have compromised the seals on the 6H well head. However, visual and photographic evidence documented that the 6H well was already on fire as of 1732 on February 11². Subsequently, Chevron and Wild Well Control placed a heat shield between these fires and the Lanco 8H well head to prevent it from sustaining heat damage from the fires. The 6H well head ignited, burned, and then extinguished itself on February 14. The 7H well head continued to burn until approximately 1500 on February 15, continuously at first and then intermittently for the final 24 hours before finally extinguishing itself.

Air and radiation sampling in areas downwind from the pad were taken to document ambient impacts. Specifically, DEP took samples from several locations, both upwind and downwind of the well pad. Air quality sampling was conducted from February 12 to February 20, radiation protection sampling was conducted February 13 and 14. DEP also collected background water samples in nearby streams on February 13 in anticipation of any fire suppression activities by Wild Well. No environmental impacts were detected from any of the air and water samples.

On February 23, Wild Well Control successfully capped the 7H well, stopping its gas flow. On February 25, Wild Well Control successfully capped the 6H well ending the possibility of further gas leakage and fire. By March 1, the 8H well head was replaced and the site was secured.

DEP Emergency Response (ER) began demobilizing by removing its vehicles and personnel from the location on February 26, though Oil & Gas (O&G) staff continued to visit the location daily. On March 1, with the well capping stacks in place and the wells securely shut-in on the Lanco A Pad, DEP considered the emergency portion of the incident to be concluded. At this juncture, DEP ceased to have a 24-hour presence at the Lanco A well pad location.

Tuesday, February 11, 2014 – Day 1

0645

- A hissing sound began emanating from the Chevron gas well 7H in Dunkard Township, Greene County. Two workers walked toward the well head to investigate the hissing sound. The natural gas ignited and in the fire, one of the workers went missing. BOI says they worked for 2 different contactors.

0710

- Wild Well Control was contacted by Chevron and was requested to respond.

² It was later determined that the 6H was leaking from 2 of its valve bonnets, presumably because the bonnet seals had been damaged by the heat of the 7H fire.

0713

- Greene County reported a “gas well fire with explosion” at 641 Bald Hill Church Road in Dunkard Township to Pennsylvania Emergency Management Agency (PEMA). The Bobtown Fire Chief was on scene.

0735

- The DEP Southwest Region (SWR) Duty Officer was notified of the well fire.

0746

- The Greene County Emergency Management Agency (EMA) Director, enroute to the scene, requested that all personnel temporarily evacuate the site. Fire Department units #17 (Dunkard Twp.), #18 (Mount Morris), #63 (Greensboro) and #65 (Carmichaels) and two (2) EMS units responded and were on scene. All units staged on the access road to the Lanco A Pad.

~0830

- DEP Emergency Responder (ER) and O&G employees Scott Sabocheck and Dan Orrahood arrived on scene.

0848

- Chevron personnel arrived on scene.
- Pennsylvania State Police (PSP) Troop B personnel arrived and established a ½ mile perimeter around the site.
- The Greene County EMA Director arrived on scene.

0931

- Chevron established a Unified Command Center at a well pad near the Lanco pad called the Miller pad. Unified Command was established with PSP. Chevron’s John Sanclemente, Source Control Chief was deemed leader of the Unified Command Center.

1106

- Washington County’s mobile command center was dispatched to support Greene County EMA and Fire units #18 (Mount Morris), #63 (Greensboro) and #65 (Carmichaels).
- The fire was fully engulfing the pad site, but was not threatening other structures.

1202

- Wild Well Control staff arrived at Chevron’s Moon Twp. office.

1810

- Wild Well Control personnel arrived on site and conducted a site assessment.
- A safety perimeter of 650 feet from the well heads was established by Wild Well based on methane gas readings of 15% of the Lower Explosive Limit (LEL) at this distance. The LEL for methane is 5% atmospheric volume. The safety perimeter extended approximately 465 ft. from the edge of the well pad.

Wednesday, February 12, 2014 – Day 2

0900

- Chevron provided a briefing at the Incident Command Center.³

1008

- John Stefanko, DEP Deputy Secretary for Mining Operations, reported that DEP staff contacted Dana Mining, the operator of a nearby mine, and checked maps of the location of the mine in relation to the fire. The fire was burning near the entrance of the mine.
- Dana Mining reported the fire was not impacting the mine underground. The fire-boss inspected the mine and anticipated that the miners would return to work that afternoon. The only issue of concern was the potential for smoke or fumes to enter the mine from the surface.
- DEP staff and Dana Mining continued to monitor the mine and took appropriate actions to ensure the safety of the miners.

1216

- Vince Brisini, DEP Deputy Secretary for Waste, Air, Radiation and Remediation, directed Nicholas Lazor, DEP Air Quality (AQ) Program Manager, to have SWR staff collect air samples using Suma canisters at residential dwellings in the vicinity of the well fire. SWR AQ personnel collected grab samples and a 24-hour sample in the vicinity of Davistown along Pigeon Hill Road, as well as a sample taken upwind of the incident for background. The air samples were analyzed for the following:

³ Well control status briefings were scheduled for 0900, 1200, 1500, and 1800 throughout the course of the incident. Many of the events listed from this point forward are from those briefing reports.

1,1,1-Trichloroethane	1-Ethyl-4-methylbenzene	Dichlorodifluoromethane
1,1,2,2-Tetrachloroethane	2-Hexanone	Ethylbenzene
1,1,2-Trichloroethane	Acetone	Hexachlorobutadiene
1,1,2-Trichlorotrifluoroethane	Acrolein	m/p-Xylene
1,1-Dichloroethane	Benzene	MEK
1,1-Dichloroethene	Bromodichloromethane	Methyl tert-Butyl Ether
1,2,4-Trichlorobenzene	Bromoform	Methylene Chloride
1,2,4-Trimethylbenzene	Bromomethane	MIBK
1,2-Dibromoethane	Carbon Disulfide	n-Heptane
1,2-Dichlorobenzene	Carbon Tetrachloride	n-Hexane
1,2-Dichloroethane	Chlorobenzene	o-Xylene
1,2-Dichloropropane	Chloroethane	Propene
1,2-Dichlorotetrafluoroethane	Chloroethene (vinyl chloride)	Styrene
1,3,5-Trimethylbenzene	Chloroform	Tetrachloroethene
1,3-Butadiene	Chloromethane	Tetrahydrofuran
1,3-Dichlorobenzene	cis-1,2-Dichloroethene	Toluene
1,4-Dichlorobenzene	cis-1,3-Dichloropropene	trans-1,2-Dichloroethene
1-bromopropane	Cyclohexane	trans-1,3-Dichloropropene
	Dibromochloromethane	Trichloroethene
		Trichlorofluoromethane

1243

- The Chevron on Scene Coordinator became Jim Prementine and the Chevron Incident Commander at the Moon Twp. Command Center was Blake Locke.
- Mine Safety and Health Administration personnel were on the scene to work with the mine.
- A three mile radius no fly zone was established. The height of the no fly zone was 3,000 feet.

1330

- Kelly Burch, DEP Executive Director of O&G Operations, arrived at Unified Command Center.

1400

- DEP Secretary Abruzzo and Executive Deputy Secretary (EDS) Dana Aunkst, arrived at Unified Command Center.

~1600

- DEP staff, including Secretary Abruzzo and EDS Aunkst, were taken to the Lanco observation point, which was a point at the top of the hill overlooking the pad, approximately 700 yards from the well, to observe the well fire.

1700

- Secretary Abruzzo and EDS Aunkst arrived at the Joint Information Center (JIC), established by Chevron at the Bobtown Polish Club, at the request of the media. They were joined by John Poister, DEP Community Relations Coordination for the SWR.

Thursday, February 13, 2014 – Day 3

1034

- SWR AQ took 3 grab samples and a 24- hour sample collocated with one of the grab sample locations on the NE side of the well near the intersection of Rocky Run Road and Water Tank Road in Bobtown and one sample taken upwind of the incident for background.
- The characteristics of the well fire changed. There was no longer a continuous flame and it was speculated that well fluids were extinguishing the flames. The fluids could have been brine (production fluids) or residual stimulation fluids.

1035

- Deputy Secretary Brisini directed Dave Allard, Director of the DEP Bureau of Radiation Protection (BRP), to have BRP personnel collect samples and take readings to document any radiation hazards associated with the fire.

1104

- Dwight Shearer, Program Manager SWR BRP, reported that BRP from the SWR was now working with AQ staff to take radiation readings/samples at the same locations that AQ samples were collected.

1254

- Secretary Abruzzo and EDS Aunkst arrived at Unified Command. Chevron engineer Patrick Ryan briefed Secretary Abruzzo and EDS Aunkst on the status of the response to the incident.
- There was no change in status. The gas well continued to re-ignite and go out. Gas meters were set up at the site to set off an alarm if 10% of the LEL for methane was measured. Chevron provided a map showing air monitoring locations that were set up at approximately half of the site. DEP directed that monitoring should be expanded to the entire site.
- DEP collected background water samples in nearby streams in the event that Wild Well Control decided to use water or chemicals to extinguish the fire.

~1600

- Senator Timothy Solobay arrived at the Lanco observation point and met with Secretary Abruzzo.

~1700

- Secretary Abruzzo and EDS Aunkst arrived at the JIC to address the media. Chevron staff at the JIC did not address the media.

1843

- The Lanco 7H well was still re-igniting.
- Wild Well Control removed 10 vehicles from the site. The rig blocking the Dana Mine access road was moved so mine personnel could access their pump.

- Chevron asked DEP for approval to withdraw water from Dunkard Creek for fire suppression purposes.
- Chevron's air monitoring for explosive levels of methane continued only during the hours workers were on the site.

~2000

- Secretary Abruzzo and EDS Aunkst departed, informing Chevron on-scene manager, Patrick Ryan that John Ryder, DEP Director of DOGO, would be arriving on February 14 to assume the senior management coordination role for DEP during the incident.

Friday, February 14, 2014 – Day 4

0722

- Dwight Shearer reported that SW BRP's three one hour air particulate samples collected on February 13 were sent to the DEP Bureau of Laboratories for analysis. Each sample location was scanned with a hand held instrument; all readings were background (5-10 µR/hr.) levels only.
- Chevron took field samples at the same locations.

0800

- Director Ryder arrived at the Unified Command Center.

~1000

- Scott Sabocheck and Dan Orrahood spoke with several nearby residents to apprise them of the well control response and DEP's monitoring efforts.

1032

- DEP approved Chevron's proposal to withdraw water from Dunkard Creek along Bald Hill Church Rd at (39°45'19.64"N, 80° 0'35.85"W) at 1,512,000 gallons per day.

1043

- The 6H well caught fire, demonstrating that the 6H well was leaking gas. The 7H well status changed back to a continuous flame, similar to the first day.
- Wild Well Control requested access to 10,000 bbls. of water per day. They planned to control runoff by utilizing collection channels which would direct runoff into lined sediment traps and recycling the water back up to the water tanks.
- Wild Well Control continued to remove vehicles off site to a secure location.
- Additional earth work was conducted and rock was being brought in for pad stability.
- Chevron brought in an additional contractor to conduct air monitoring which provided Chevron real time data over a wireless system. The monitoring locations were on all four corners of the pad.
- DEP requested air monitoring reports from all Chevron monitoring locations on an hourly basis.

1311

- The 6H well ignited again and burned from 1030 through 1130 and then extinguished itself.
- Radiation monitoring of all the equipment taken off site showed no levels of radioactivity higher than background.

1741

- SW BRP completed a 2nd round of radiation monitoring. All meter readings were at background levels.

1800

- The 7H well status changed when the well started extinguishing and reigniting again.
- 54 loads of stone and ten 500 barrel water tanks were brought onto the site.
- Seven pieces of equipment were moved from the site including a large wireline truck.
- The three mile radius no fly zone, established February 12, was extended until February 16 at 1800. The height of the no fly zone remained 3,000 feet.

1945

- Director Ryder went to the JIC to provide a press briefing.

Saturday, February 15, 2014 – Day 5

0800

- Scott Perry, DEP Deputy Secretary for the Office of Oil and Gas Management, arrived at Unified Command Center.

0900

- The status of the 7H well was still intermittently igniting, through the 6H well was not burning.

0950

- DEP personnel requested air monitoring updates from Chevron monitors at least every two hours. Chevron stated that it would alert DEP if the monitors detected methane at 10% of the LEL. Chevron began providing updates every four hours on air monitoring results. Chevron provided a map of the Air Monitor Sensors.

1800

- It was reported that the 7H well status changed. The 7H well stopped burning at approximately 1500 and had not burned since. A plume of gas was blowing off the pad which traveled in an easterly direction, rising as it went. No ground based air quality sensors detected methane at levels of concern.
- A crane was removed from the safety perimeter and 27 loads of stone were brought onto the site.

Sunday, February 16, 2014 – Day 6

0900

- Construction work on the pad was completed this day and the remaining water tanks were spotted on location. Water trucks began filling the tanks.

0945

- Deputy Secretary Perry and Director Ryder visited the JIC to respond to the media.

1200

- DEP Staff attended a technical meeting held at Chevron's Moon Twp. Incident Command Center. Chevron explained the well head design used at the site, the location of the equipment failure and Chevron's plans to bring the well under control. A failed gland nut and lockscrew assembly was identified as the reason for loss of well control. Chevron began inspecting all of its wells in Pennsylvania to ensure integrity. Chevron also suspended all hydraulic fracturing and post completion work at all Chevron sites in Pennsylvania. Chevron stated that it believed the well would be brought under control by as early as February 20.

1600

- Deputy Secretary Perry and Director Ryder met with Representative Pam Snyder at the JIC and explored the status of the Lanco well control intervention plan.

1800

- Chevron's air quality monitoring showed no readings of methane at any of the monitoring locations they had set up.
- Chevron installed a weather monitoring station at the observation location to record weather near the pad.
- All the water tanks were on site and water hauling operations began.
- Wild Well Control assembled manifolds for water movement operations at the site.

Monday, February 17, 2014 – Day 7

0900

- A work stand-down occurred on the Lanco A pad due to alarms for methane and Hydrogen Sulfide (H₂S).
- Chevron brought in a fixed H₂S monitor as well as Dräger tubes to get additional data points. Work on site would resume when additional testing of onsite air quality was deemed safe.
- Water tanks were filled and the fire extinguishing system was tested.
- A small release of brine (several quarts per minute) was discharging from the 7H well head.

~ 1100

- DEP staff, including Deputy Secretary Perry, Executive Director Burch and Director Ryder met with a nearby local resident at the request of Representative Snyder. The residence was approximately 1,800 feet below the Lanco well site.

1500

- Chevron pulled Dräger tubes for H₂S analysis and installed the ground based H₂S monitor.
- Overland water transfer line was almost complete as an approved secondary source to the water was trucked in to the Lanco pad.

Tuesday, February 18, 2014 – Day 8

0900

- Chevron determined that the H₂S readings were false readings and moisture related.
- Scott Sabocheck (DEP) received an email from Chevron detailing their community air monitoring plan. The stated goal of the plan was to evaluate impacts of combustion byproducts from the well fire. Samples for particulate matter (PM_{2.5}/ PM₁₀), Poly Aromatic Hydrocarbons (PAH) and other constituents were to be taken.

1029

- AQ continued to sample throughout the day.

1549

- AQ Samples 35DV001, 35DV002, and 35DV003 collected February 12 were analyzed.

Wednesday, February 19, 2014 – Day 9

0900

- Fire equipment tested successfully.
- 5,000 barrels of water on location was sufficient for planned operations.
- DEP was informed that from 1922 hours to 1930 hours on February 18, LEL on site was at or above 10% LEL.

1320

- The damaged crane was moved from the 7H well head.
- PSP closed the Lanco A pad while they conducted their search for the missing person.

Thursday, February 20, 2014 – Day 10

0900

- Deputy Secretary Perry and Director Ryder traveled to Chevron's Incident Command Center in Moon Twp. to discuss Chevron's well control contingency plan, moving DEP emergency responders to a forward location at the Lanco site, and Chevron's plans to ensure that future incidents do not recur.

1048

- All 12 AQ samples from the weekend (February 15, 16 and 17) showed that all air samples were at background conditions.
- AQ recommended that sampling in the vicinity cease.

1130

- Deputy Secretary Perry and Director Ryder were provided with a detailed explanation of the well capping procedure Chevron intended to use and a contingency plan that identified all potential decision points with alternative scenarios if problems with plan implementation arose. Deputy Secretary Perry requested a list of all Chevron wells that were similarly situated to the Lanco wells and an explanation of how Chevron would demonstrate that additional work on those wells could be performed safely.

1400

- Athey Wagon was moved into position and made ready for capping activities.
- Fire suppression water tanks were at 80% capacity.

1710

- AQ sampling ceased.

Friday, February 21, 2014 – Day 11

0705

- Results from all radiological samples were reported to be below the Lower Limit of Detection (LLD).

1400

- The seals were tested on the 7H well head. The results of those tests were positive indicating that the well head could contain pressure. This allowed the cut and capping process to go forward.
- The seals were being tested on the 6H and the results of these tests would be reported at the 1800 briefing.

1800

- The well head seal test on 6H was successful, demonstrating competency of the well head. These positive results allowed the cut and capping process to proceed.
- Preparation work continued, including the installation of flare stacks and ancillary equipment.

Saturday, February 22, 2014 – Day 12

1800

- All on-site tasks in preparation for the cut and capping activities had been completed.
- A dry run of all functions and operations proved successful.

- A broken hydraulic line was discovered on one of Schlumberger's blending units. The problem was reported to be correctable by morning.

Sunday, February 23, 2014 – Day 13

0947

- Wind speed was a key factor on the cut and capping process. Wind speed was 0 mph and the fixed gas monitors were reading as no higher than 7% of LEL.

1111

- Operations were shut down due to wind direction and placement of personnel and equipment. A worker's personal safety meter device measured 40% of LEL on the backside/eastern side of the well pad. The diversion tube placed on the failed lockscrew area was removed in preparation for the cut. DEP ER staff collected readings throughout the surrounding communities and no alarms were recorded.

1202

- Activities on site resumed and the cutting of the 7H well head commenced.

1400

- The cut on the 7H well head was accomplished in 55 minutes. The tubing spool was lifted and the bolts were inspected to ensure a competent seal of the capping well head.
- The section of the well head where the leak occurred was secured and shipped offsite for a root-cause examination by a third party lab.
- The capping wellhead was installed and tests were conducted to ensure a competent seal.

1638

- Chevron confirmed the capping stack was closed on 7H and the seals were intact, stopping gas flow from the well.
- The equipment was demobilized for re-rigging on 6H.

Monday, February 24, 2014 – Day 14

0900

- Equipment was moved for the cut and cap operation on the 6H well.
- The Abrasive Jet Cutter was slightly damaged on February 23 and replacement parts were installed.
- Chevron provided Deputy Secretary Perry with a list of 27 wells at seven well sites that were awaiting hydraulic fracturing, to be placed into production or plugged. Inspections of these wells showed that they were sound. Operations at these sites remained suspended pending DEP approval.

1400

- Chevron completed set-up for capping the 6H well.
- A heat shield between 7H and 6H was installed to prevent any damage to 7H.
- The capping stack for 6H was moved into place.

1800

- Weather data was continuously forwarded to DEP throughout the day and at least two hours after capping was complete.
- Chevron relocated some of the gas monitors. DEP requested a map of their locations be provided as soon as possible. The map provided by Chevron showed that approximately ½ the site was still not being monitored for gas.
- DEP insisted on more frequent updates as steps in the capping process were completed.

Tuesday, February 25, 2014 – Day 15

0900

- Cutting operations on the 6H were delayed temporarily because of freezing in the fire water lines.
- DEP staff received the Chevron air monitoring points and weather updates.
- DEP ER staff monitored gas levels in the area of the nearest homes. Methane was not detected.

1420

- The 6H cut was completed and an excavator pushed the well head off. Gas pressure from the well was estimated to be only several hundred pounds.
- No gas was detected at the onsite monitors or DEP's offsite monitors.

1600

- 6H was capped and secured. There was good seal integrity and no gas readings were observed at any monitoring point during the procedure.

1800

- A visual inspection was done of the 8H well and no obvious problems were detected.
- Chevron successfully tested the seals on the 8H well.

Wednesday, February 26, 2014 – Day 16

1200

- Chevron evaluated various diagnostic options for the 8H well and took measurements to see if the valves were distorted or affected and tested the valves to see if they could turn.

1530

- DEP requested to examine the Lanco location for possible ground contamination from a release of well fluids. This examination did not happen until after PSP concluded its recovery efforts. It was agreed that Chevron and DEP would split any soil and water samples that were taken.

1800

- Chevron found the gland nut and lockscrew assembly that was ejected from the 7H well approximately 73 feet from the well.

- Chevron ran tests on the 8H and observed no pressure below the blind flange valve on top of the frac stack. Another frac valve could be placed on the existing stack to ensure at least double valve protection on the well.
- O&G staff maintained a presence of the location daily.
- Suspected areas for additional recovery efforts of the deceased worker were fenced off for examination by the PSP.

Thursday, February 27, 2014 – Day 17

1200

- DEP inspected the equipment removed from the 6H well on February 25. In addition, a latch down pin was discovered on the Lanco site by Chevron. This may have belonged to the 7H well prior to the fire and was sequestered as evidence. DEP also inspected and photographed this object.

1800

- A 3rd valve was installed on top of the existing frac stack of the 8H well, giving at least dual control of the 8H well. In this process, the blind flange was removed and reinstalled on top of the additional valve.

Friday, February 28, 2014 – Day 18

1200

- Work continued on the 8H well. Chevron rigged up a lubricator to pressure test the valves. The former top valve on the frac stack was leaking and was removed. Chevron prepared to install a back pressure valve. If successful, a 12 hour observation period would be implemented before the well head would be changed.
- Patrick Ryan was identified as the Incident Commander (IC) for Chevron.

1800

- Chevron successfully placed a back pressure valve/plug on the 8H well below the frac valves and attached to the casing head. Chevron now had three controls in place. The top frac valve was replaced. The pressure held and the 12 hour observation began. If well pressure was contained, they would replace the well head.
- Chevron planned to de-mobilize Wild Well Control and hand the site over to PSP on March 3, depending on weather.
- The March 1, 1200 phone conference would be the last Unified Incident Command (UIC) briefing. Chevron would begin daily email updates.

Saturday, March 1, 2014 – Day 19

- The 8H well was secured and a new well head was installed, including a tubing spool.
- The old well head was taken to the Lanco B pad, where all the other removed equipment from 6H and 7H were located.
- Chevron evaluated the gland nut and lockscrew assembly tolerances at the seven well sites identified as being similarly situated to the Lanco A site.

- The following schedule was developed: The Lanco A site would be turned over to the PSP on March 3 for recovery activities. The forensics team would examine the site on March 4. On March 5, remaining debris would be removed from the Lanco A site. Joint soil and water sampling by DEP and Chevron was scheduled for March 5.
- Chevron began to demobilize its UIC center.
- This was the last regular briefing. Updates were sent to DEP to appraise of any additional activities and developments by Carl Ciccarelli from Chevron.

Monday, March 3, 2014 – Day 21

- Chevron informed DEP that the Greene County Coroner (Coroner) and the PSP were scheduled to conduct a search for additional human remains at the Lanco Pad A on March 4. According to PSP, the scope of the Coroner's recovery effort was to include the area where human remains were discovered on February 19, including the original Crane #1 location, the path where Crane #1 was moved in preparation for its removal from the site, and the area where Crane #1 was lifted for transport to Lanco Pad B.

2. Problems Encountered:

Communications

- a. The area in which the emergency occurred had poor cell phone reception. Email and/or internet access was also limited. As a result of this poor coverage, DEP staff utilized hand held radios to facilitate more consistent communication throughout the incident. Radio deployment and communications was not well coordinated in the early stages of the incident.
- b. Throughout the event, a considerable amount of time was spent transferring relevant information at each shift change. The major activities or events that occurred during the previous operational period were mostly transferred between employees orally.
- c. Chevron failed to continually provide meaningful update information on the emergency incident during the regularly scheduled briefings held at the Unified Command Center location at the Miller Pad. DEP staff were excluded from discussions at the Miller Pad Unified Command Center with Chevron and Wild Well while they developed the information provided at the regularly scheduled briefing.
- d. Chevron controlled access at the site based on what they believed were PSP directives. DEP personnel were prevented from accessing areas of the site on several occasions. Proper coordination and communication between PSP, Chevron, and DEP could have prevented this situation.
- e. On several occasions, DEP requested that Chevron brief the media on the ongoing situation. Chevron did set up and staff a Joint Information Center (JIC) located at the Bobtown, PA, Polish Club on February 12, but then made a decision to move the JIC to Morgantown, WV on February 16. Locating the JIC at a location where media could

better access Chevron personnel would have improved communication with the public. The JIC should have included personnel that were authorized to speak freely on behalf of the company.

- f. There was uncertainty about the location of the actual decision making authority for the incident (on site or at Moon Twp.). Chevron was not clear with DEP staff where such discussions were being held and which Chevron personnel had ultimate decision making authority.
- g. On February 19, LEL safety exceedances were noted by Chevron but not immediately reported to DEP staff on site.

3. Lessons Learned from the Response:

a. Management of Incidents

- i. Wild Well Control's response was acceptable. Initial arrival was within five hours of the incident and the team assembled within 12 hours. In the interim, trained first responders secured the site and identified and addressed immediate safety concerns.
- ii. The requirement for operators to establish 911 addresses for well sites proved to be extremely valuable and appropriate during this incident.
- iii. Chevron's emergency response plan was sufficient, although communication with DEP was too guarded.
- iv. The first responders and emergency responders performed their roles in a well executed manner.
- v. Operators must be clear about who is making ultimate decisions and at which location these decisions are being made.
- vi. DEP must have the appropriate staff present in both the Unified and Incident Command locations as soon as possible. It is also important to place the appropriate DEP technical/management personnel in the Incident Command Center to participate with the appropriately designated group discussing well control scenarios, options, and timeframes.
- vii. A JIC should be set up in a location that is accessible to local media. Additionally, the JIC must include personnel that are authorized to speak on behalf of the company.
- viii. DEP should develop an Agency Media Communications Plan for Major Emergencies. DEP should assign a Community Relations Coordinator to the JIC to conduct briefings for the media.

- ix. DEP must coordinate more closely with PSP when both agencies are on sight to clearly establish roles and authority.

b. Training and Procedure

- i. DEP should develop a separate Response Protocol for significant incidents. This Response Protocol would address the coordination of emergency management between Senior Managers identified to coordinate the operational response during these significant incidents. This coordination includes establishing DEP's authority on a site and assuring that staff has proper equipment, access and adequate staffing necessary to perform their function.
- ii. DEP should assess staff needs for appropriate HAZWOPER certification for entry onto designated emergency sites/locations.
- iii. Legal Access Training should be provided for all DOGO personnel.
- iv. DEP should develop joint training opportunities for both O&G and ER personnel centered on well control incidents, including providing a log or record book where each employee may record the significant actions or events that occurred during their shift. The record book will then provide a complete record of O&G related activities and be available for review at any time.
- v. DEP should immediately assert our oversight authority with operators at any emergency response incident.

4. Recommendations to Prevent Future Incidents:

A separate report, prepared by the DEP's Bureau of Investigations are attached to this After Action Review, indicates that this incident may have been caused by human error that resulted in the ejection of a gland nut and lock screw assembly from the well, allowing methane gas under high pressure to be emitted and ignite. The source of the ignition is not known at this time. As natural gas well development frequently requires numerous pieces of equipment or devices that could act as an ignition source, resolving this question is far less critical than understanding how the assembly came to be ejected, and what can be done to prevent a recurrence of this event.

Lock screws are used in surface wellhead equipment to mechanically energize or retain internal wellhead components. Although the exact reason why the gland nut and lock screw were ejected from the well head is not conclusively known, the suspected cause of the failure is that the assembly was loosened several days before this incident and was not properly re-secured.

While DEP will continue to investigate this matter, the measures identified by Chevron and Cameron International as items a – h below, if followed, should ensure that gland nut and lock screw assemblies remain secure during well operations. In particular, following recommendation f, which Chevron has committed to do in all future unconventional wells drilled in Pennsylvania, completely eliminates the possibility of such a recurrence as the assemblies are

never exposed to internal wellbore pressure. These measures will be shared with all operators in Pennsylvania who utilize gland nut and lockscrew assemblies.

- a. Verify adequate engagement of gland nuts;
- b. Confirm lockscrew assemblies' torque values are consistent with manufacturer's specifications;
- c. Inspect lockscrew assemblies for any debris or damage such as scarring or bending;
- d. Follow manufacturer's procedures if checks show any of the above are inconsistent with the manufacturer's specifications;
- e. Conduct a pressure test to rated maximum working pressure to ensure gland nut and lockscrew assemblies have pressure integrity;
- f. Consider isolating gland nut and lockscrew assemblies from wellbore pressure by having tubing hangers and adapters installed;
- g. Reinforce with relevant personnel training and the use of procedures to address hazards associated with performing work on wellhead assemblies exposed to wellbore pressure;
- h. Review and implement appropriate engineering and well design controls (physical design of equipment) and administrative controls (procedures) to address the hazards of work involving gland nut and lockscrew assemblies.