



MDE Maryland Department of the Environment

Update on Maryland's Draft Marcellus Shale Risk Assessment Findings

Presentation to the Marcellus Shale Advisory Commission

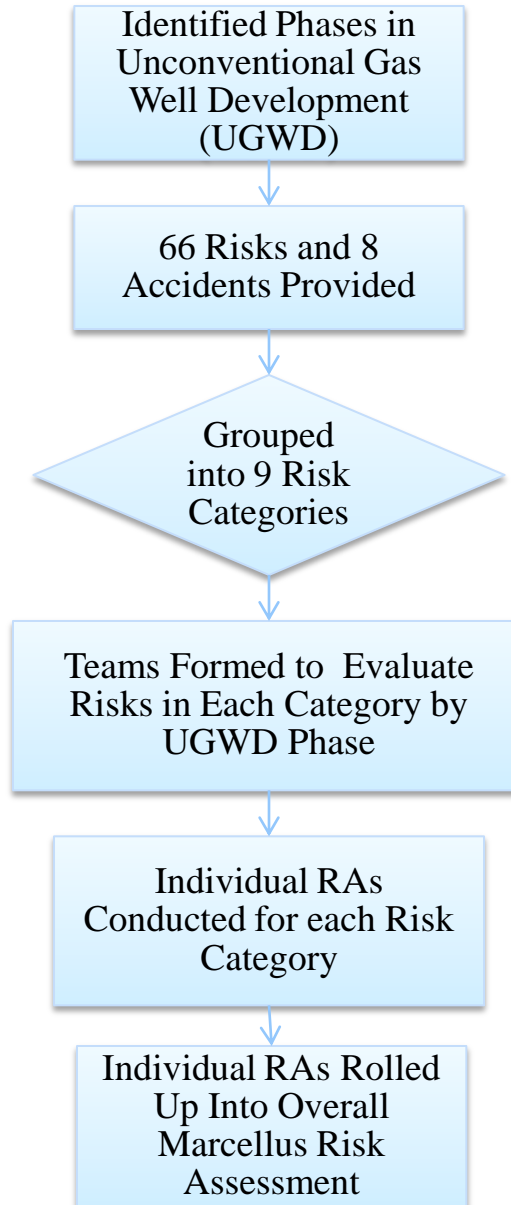
9/15/14



Background and Introduction

1. Maryland's Risk Assessment (RA) was developed by the Departments in response to Commission request.
2. Draft Commission work plan used as a guide.
3. RA Team formed (Jan. 2014) included a medical doctor, engineer, biologists/ecologists, natural resource planners, and staff with expertise in water quality standards, toxicology, and statistics.

RA Methodology



Phases of UGWD*

1. Site Identification
2. Site preparation
3. Drilling, Casing, Cementing
4. Hydraulic Fracturing/Completion
5. Well Production/Processing
6. Site Reclamation and Abandonment

*From Key Documents, including Ricardo (2013) and King (2012) RAs, and NYSGEIS (2011).



Risks Considered*

Impact to	From	Activity	Team Addressing	Step
Air quality	Methane	Escape of methane during fracking and well completion	TEAM 1 - Air Emissions	4
Air quality	Methane	Escape of methane during drilling	TEAM 1 - Air Emissions	3
Air quality	VOCs	On-site pit or pond storage	TEAM 1 - Air Emissions	3,5
Air quality	Conventional air pollutants and CO2	Compressor operation	TEAM 1 - Air Emissions	3,5
Air quality	VOCs	Condensate tank, dehydration unit operation	TEAM 1 - Air Emissions	3
Air quality	Diesel exhaust	Fuel burning equipment on the pad site	TEAM 1 - Air Emissions	2
Air quality	Dust	Construction and traffic on dirt roads	TEAM 1 - Air Emissions	2,5,7
Community	Damage to roads	On-road vehicle activity during site development	TEAM 1 - Air Emissions	2,7
Surface water	Flowback and produced water constituents	Application of wastewater for road deicing, dust suppression	TEAM 2 - Vehicles and Roads	5
Community	Industrial landscape	Clearing of land for roads, well pads, pipelines, evaporation ponds	TEAM 2 - Vehicles and Roads	1,2
Community	Road congestion	On-road vehicle activity during site development	TEAM 2 - Vehicles and Roads	1,2
Community	Road congestion	On-road vehicle activity during drilling	TEAM 2 - Vehicles and Roads	3
Community	Road congestion	Transport off-site	TEAM 2 - Vehicles and Roads	3,5
Community	Road congestion	On-road and off-road vehicle activity during fracking	TEAM 2 - Vehicles and Roads	4
Air quality	Diesel exhaust	On road vehicles	TEAM 2 - Vehicles and Roads	2,5
Surface water	Drilling fluids and cuttings	Disposal of drilling fluids, drill solids, and cuttings	TEAM 3 - Drilling Fluids and Cuttings	1,3
Groundwater	Drilling fluids and cuttings	Disposal of drilling fluids, drill solids and cuttings	TEAM 3 - Drilling Fluids and Cuttings	1,3
Surface water	Drilling fluids and cuttings	Storage of drilling fluids at surface	TEAM 3 - Drilling Fluids and Cuttings	1,3
Surface water	Drilling fluids and cuttings	Drilling equipment operation at surface	TEAM 3 - Drilling Fluids and Cuttings	1,3
Air quality	Radioactivity	Handling and disposal of drill cuttings and flowback	TEAM 3 - Drilling Fluids and Cuttings	1,3
Habitat	Noise, light, traffic	Drilling	TEAM 3 - Drilling Fluids and Cuttings	1,3
Surface water	Flowback and produced water constituents	Leak or release from tank	TEAM 3 - Drilling Fluids and Cuttings	4,5

*From scoping document and including additional risks identified by the Commission



Grouped Risks

1. Air Emissions
2. Vehicles and Roads
3. Spills/Releases of Drilling Fluids and Cuttings
4. Fracking/Flowback Fluid Spills and Risks to Surface/Ground water
5. Noise/Visual Impacts
6. Chemical/Methane Releases from Wells or Formation
7. Water Withdrawal/Appropriations
8. Liquid and Solid Waste Treatment, Use and Disposal
9. Habitat Fragmentation, Ecological Impacts and Invasive species

RA for UGWD Phases

- 9 RA Teams formed – one for each risk category.
- Teams described/quantified activities in each UGWD phase that influenced risks.
- Teams reviewed current scientific literature or other avail. info. on risks associated with UGWD.
- Teams evaluated current regulations and proposed BMPs effectiveness in mitigating risks.
- Teams ranked risks for each UGWD phase.



Factors Used to Rank Risks

Probability	Definition
Low	Rarely happens under ordinary conditions; not forecast to be encountered under foreseeable future circumstances in view of current knowledge and existing controls on gas extraction
Moderate	Occurs occasionally or could potentially occur under foreseeable circumstances if management or regulatory controls fall below best practice standards
High	Occurs frequently under ordinary conditions
Insufficient Data to Determine	Lack of available data to confidently assign probability

Consequence	Definition
Minor	Slight adverse impact on people or the environment; causes no injury or illness
Moderate	Considerable adverse impact on people or the environment; could affect the health of persons in the immediate vicinity; localized or temporary environmental damage
Serious	Major adverse impact on people or the environment; could affect the health of persons in a large area; extensive or permanent environmental damage
Insufficient Data to Determine	Lack of available data to confidently assign consequence

Risk Ranking Methodology

Probability →

↓ **Consequence**

Risk Rank	Low	Medium	High
Minor	Low	Low	Moderate
Moderate	Low	Moderate	High
Serious	Moderate	High	High



Overall Marcellus Risk Assessment

- Findings from the individual teams used to develop an overall Executive Summary Level Marcellus Risk Assessment.
- Each of the team reports are attached as appendices.
- Detailed appendices can be used to identify UGWD phases that may need additional BMPs.



Standardized Assumptions Used

- Individual Site Impacts, 150 well, and 450 wells.
- 15-acres Site disturbance per pad.
- 5-million gallons water/well.
- 30% flowback volume.
- Generally consistent assumptions for activity duration.
- Number of truck trips.



Standardized Assumptions, cont.

Well Pad Activity	Scaling/ Coefficient 6 wells/pad	Early well pad scenario (All water transport by truck)	
		Heavy trucks	Light trucks
Drill pad construction	1	45	90
Rig mobilization	2	190	280
Drilling fluids	6	270	
Non-rig drilling equipment	2	90	
Drilling (rig crew, etc.)	6	300	840
Completion chemicals	6	120	1956
Completion equipment	2	10	
Hydraulic fracturing equipment (trucks & tanks)	2	350	
Hydraulic fracturing water hauling	6	6000	
Hydraulic fracturing sand	6	138	
Produced water disposal	6	1800	
Final pad prep	1	45	50
Miscellaneous	-	0	400
TOTAL truck trips per well (1 well on 1 pad)	-	9358	3616

Items Outside of RA Scope

- Health/Safety risks to workers on site (regulated by OSHA).
- Climate change risks.
- Risks from Downstream Infrastructure (natural gas liquefaction plants, gas main and transmission lines).
- A conclusion about the acceptability of the risk.



Current Draft Report Timeline

- Expected to be released in the next two weeks.
- Will initiate a 30-day public review period.

Preliminary Draft Findings

- Highlight regulatory standards or other appropriate measures used to rank risk.
- Identify scope of risk assessment (i.e., single, 150 and/or 450 wells).
- Present human risk findings (i.e., ecological/other risks not shown) for a single aspect in each risk category.
- Discuss key factors influencing RA findings.



Preliminary Noise/Vibration Impacts from Vehicular Traffic

- Relied on noise standards exceedance at one's property line and truck decibel data to determine risk ranking.
- Considered noise from truck traffic for a single 6-well pad as noise not additive and anticipated distance between pads will attenuate noise.



Noise/Vibration Impacts from Traffic

Aspect	Agent/ chemical	Impact on	UGWD Phase				
			Site identification/ preparation	Drilling, casing and cementing	HVHF / Well completion	Production	Well abandonment / reclamation
Noise / vibration	Vehicle traffic	Human / Community	Low	Moderate	High	Low	Low

Key Factors Influencing RA findings:

1. Differences in vehicular traffic between phases and associated truck decibel levels; and,
2. Pad BMPs (e.g., setbacks) do not attenuate noise from road traffic.

Preliminary Water Appropriations Impacts to Local/Regional Supply

- Primarily relied on the current regulatory program in protecting drinking water supply to determine risk ranking.
- Considered appropriations impacts from a single well and the 150 and 450 well development scenarios to evaluate site-specific and regional impacts of water withdrawal.



Appropriation Impacts to H₂O Supply

Aspect	Agent/ chemical	Impact on	UGWD Phase				
			Site identification/ preparation	Drilling, casing and cementing	HVHF / Well completion	Production	Well abandonment/ reclamation
Water appropriation	Withdrawals from surface or groundwater	Local and regional drinking water supplies	N/A	Low	Low	N/A	N/A

Key Factors Influencing RA findings:

1. Robust permits likely required for all wells; include annual/daily maxima and consider cumulative impacts.
2. Both 150 and 450 wells water use small in regional supply context.
3. Appropriation plan required as part of CGDP, also flowback recycling.

Preliminary Groundwater Impacts from Methane Migration

- Primarily relied on scientific literature data on cementing/casing failure, observational studies of private well methane contamination in proximity to UGWD, and extensive BMP implementation to determine risk ranking.
- Considered pathways for contamination from a single well.

Groundwater Impacts from Methane

Aspect	Agent/ chemical	Impact on	UGWD Phase				
			Site identification/ preparation	Drilling, casing and cementing	HVHF / Well completion	Production	Well abandonment / reclamation
2,000' Private Well Setback	Methane	Human	NA	Low	Low	Moderate	Low
3,260' Private Well Setback			NA	Low	Low	Low	Low

Key Factors Influencing RA findings:

1. Studies (Jackson 2013) finding decreased methane in groundwater 1 km from UGWD from either casing/cementing failure during well construction or over time.
2. Application of extensive BMPs.
3. Risks continue throughout production phase.

Q&A



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