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American Carbon Registry and California Air Resources Board Mine Methane Capture Offset Projects

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June 11, 2014

Agenda

Introduction to ACR and ACR's Role in California's Cap & Trade Program

Lauren Nichols, Technical Manager, ACR

Overview of ARB Mine Methane Capture Protocol

Jessica Bede, Air Pollution Specialist, California Air Resources Board

Development and Verification of Mine Methane Projects

Michael Coté, President, Ruby Canyon Engineering

Mine Methane Project Listing, Verification, and Credit Issuance on ACR

Eric Ripley, Program Manager, ACR

Q & A

Webinar Logistics

Asking questions

- Either during presentation or Q&A period at end
- Type questions into '**Chat**' box near bottom of your webinar pane or click hand icon to ask in person. Please include your name and organization.
- We will direct questions to the appropriate person during the Q&A period at the end
- We will try to answer all questions and will make our best effort to respond to any questions not addressed during the call via email

Webinar will be recorded

- Both the presentation and a link to the recording will be sent to all registered webinar participants

American Carbon Registry

Introduction to ACR and ACR's Role in California's Cap & Trade Program

Winrock International Institute for Agricultural Development

Non-profit organization that works in the U.S. and around the world to empower the disadvantaged, increase economic opportunity, and sustain natural resources

- Formed in 1985 from three Rockefeller family organizations
- Dedicated to economic development and sound resource management in the U.S. and around the world
- Climate change and its impacts on the poor are a central concern
- Supports market mechanisms as a means to improve the environment and alleviate poverty

American Carbon Registry

- **First U.S. private voluntary GHG registry**, founded 1996
  - Over 40 million tons of emissions reductions issued
  - Joined Winrock International in 2007
- **Registry roles:**
  - Develop and approve carbon offset accounting standards & methodologies / protocols
  - Oversee independent verification by accredited entities
  - Review and register GHG emissions reduction projects, including issuance of serialized offsets
  - Transparently track transactions and retirements
- **ARB-approved** in December 2012 as Offset Project Registry (OPR) and Early Action Offset Program (EAOP) for the California cap and trade market
  - Supports ARB's implementation of the Cap-and-Trade
  - Offset Program from ACR's Sacramento office

The Role of the Offset Project Registry (OPR)

- Compliance offset projects must register with an ARB-approved OPR; early action offset projects must register with an ARB-approved Early Action Offset Program (EAOP).
- The OPR will oversee the project listing, verification, registration and issuance of Registry Offset Credits developed using ARB-approved compliance offset protocols.
- Once approved by ARB, issued Registry Offset Credits can be cancelled on the OPR and re-issued as ARB Offset Credits on the CITSS

Why ACR?

- Technical expertise in carbon protocols = quick and accurate answers
- In-depth understanding of early action and compliance protocols
- Long track record of project review, verification oversight and credit issuance
- Customer service oriented and responsive
- Competitive fee structure including no issuance fees
- Open channel of communication with ARB to address questions and provide consistent interpretations
- An enterprise of an internationally recognized and mission-driven NGO, Winrock International

Technical Expertise

- First US GHG registry: Two decades of experience in protocol development, project review, verification oversight and credit issuance
- Protocol development in-house and with partners
  - Reforestation, IFM, REDD, industrial gases, grazing land/livestock management, N_2O from fertilizer management, rice management, wetlands restoration, fleet efficiency, pneumatic valves, avoided conversion of grasslands, CCS and others
- Staff with extensive offset verification & project development experience
- ACR team accredited in all ARB compliance protocols as well as Offset Project Registry operations and Project Verification
- Three ACR staff attended recent Coal Mine Methane Protocol Training at ARB for accreditation
- Able to draw on Winrock forest carbon, clean energy and agriculture experts for additional technical input

Competitive Pricing

Account opening:	$500
Annual account fee:	$500
Project listing fee:	$750/ compliance offset project

Offset issuance fee:	Free
Offset activation fee:	$0.15/offset*
Offset cancellation fee:	$0.03/offset*
Offset transfer fee:	$0.02/offset

**** Total of $0.18/offset for issuance, activation and cancellation when ARB requests cancellation of ROCs or EAOCs***

Compliance Offset Protocol Mine Methane Capture Projects

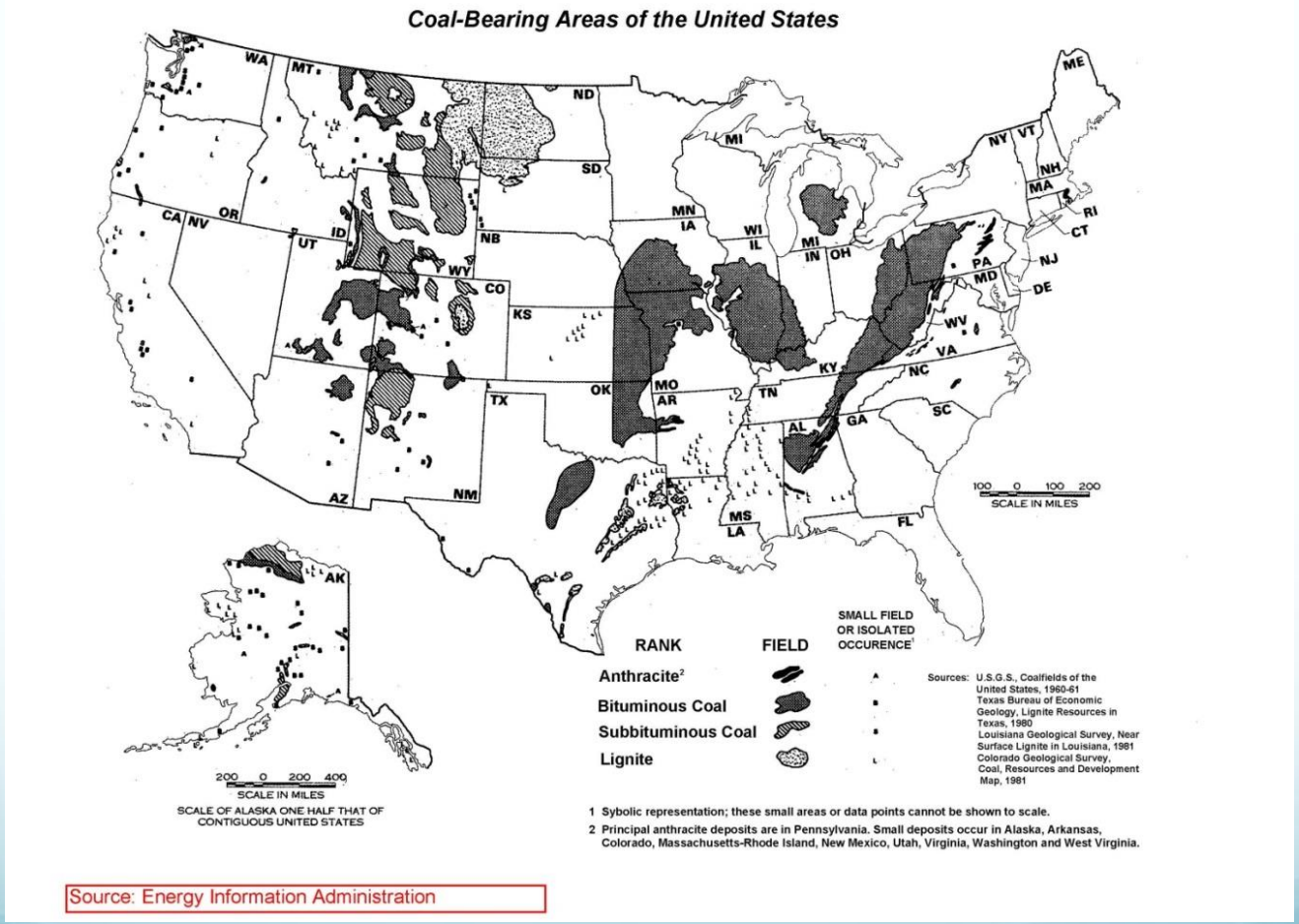
Capturing and Destroying Methane from U.S. Coal and Trona Mines

American Carbon Registry Webinar
June 11, 2014

Protocol Overview

- Compliance Offset Protocol for Mine Methane Capture (MMC) Projects was adopted by the Board at the April Board hearing
  - Pending approval by the Office of Administrative Law, the MMC Protocol will go into effect on July 1, 2014
- Purpose: To quantify greenhouse gas emission reductions associated with the capture and destruction of methane that would otherwise be vented into the atmosphere as a result of mining operations at:
  - Active underground coal and trona mines
  - Active surface coal and trona mines
  - Abandoned underground coal mines

U.S Coal Mining Regions



Source: Energy Information Administration

Protocol Overview

- **Active underground mine:** A permitted mine usually located several hundred feet below the earth's surface. A mine must be classified by the Mine Safety and Health Administration (MSHA) as active, intermittent, or temporarily idle in order to be eligible for an active underground mine methane drainage or ventilation air methane activity
- **Active surface mine:** A permitted mine in which the mineral lies near the surface and can be extracted by removing the covering layers of rock and soil. A mine must be classified by the Mine Safety and Health Administration (MSHA) as active, intermittent, or temporarily idle in order to be eligible for an active surface mine methane drainage activity
- **Abandoned underground mine:** A mine where all mining activity including mine development and mineral production has ceased, mine personnel are not present in the mine workings, and mine ventilation fans are no longer operative. A mine must be classified by MHSA as abandoned or abandoned and sealed in order to be eligible for abandoned mine methane recovery activity.

General Eligibility

- Projects install and operate equipment to capture and destroy mine methane or ventilation air methane that would otherwise be vented into the atmosphere as a result of mining operations
- Captured methane is destroyed through an eligible end use management option (oxidation, flaring, power generation, heat generation, production of transportation fuel, injection into natural gas pipeline, etc.) using a qualifying destruction device
- Mines must be located in the United States; mines on federal lands are eligible
- Offset Project Operator must have legal authority to implement the project
- Offset project commencement date is the date on which methane capture and destruction equipment begins capturing and destroying methane upon completion of an initial start-up period

General Eligibility

- Four eligible project activities
  - Active underground mine ventilation air methane
  - Active underground mine methane drainage
  - Active surface mine methane drainage
  - Abandoned underground mine methane recovery

Active Underground Mine Ventilation Air Methane Activities

- Eligible Methane Sources
  - Ventilation systems
  - Methane drainage systems from which mine gas is extracted and used to supplement ventilation air
- A qualifying destruction device must not have been operational at the mine prior to offset project commencement
- VAM from any ventilation shaft connected to a non-qualifying destruction device at any point during the year prior to offset project commencement is not eligible for crediting

Active Underground Mine Methane Drainage Activities

- Eligible Methane Sources
  - Pre-mining surface wells
  - Pre-mining in-mine boreholes
  - Post-mining gob wells
- Mine methane from any well or borehole connected to a non-qualifying destruction device at any point during the year prior to offset project commencement is not eligible for crediting
- A qualifying destruction device must not have been operational at the mine prior to offset project commencement
  - Injection into a natural gas pipeline is not an eligible end use

Active Underground Mine Methane Drainage Activities

- Projects must not:
  - Account for virgin coal bed methane extracted from coal seams outside the mine extents or from outside the methane source boundaries
  - Use CO_2, steam, or any other fluid/gas to enhance mine methane drainage

Active Surface Mine Methane Drainage Activities

- Eligible Methane Sources
  - Pre-mining surface wells
  - Pre-mining in-mine boreholes
  - Existing coal bed methane wells that would otherwise be shut-in and abandoned as a result of encroaching mining
  - Abandoned wells that are reactivated
  - Converted dewatering wells
- Mine methane from any well or borehole connected to a non-qualifying destruction device at any point during the year prior to offset project commencement is not eligible for crediting

Active Surface Mine Methane Drainage Activities

- A qualifying destruction device must not have been operational at the mine prior to offset project commencement
- Projects must not:
  - Account for virgin coal bed methane extracted from coal seams outside the mine extents or from outside the methane source boundaries
  - Use CO_2, steam, or any other fluid/gas to enhance mine methane drainage
  - Occur at mines that employ mountaintop removal mining

Abandoned Underground Mine Methane Drainage Activities

- Eligible Methane Sources
  - Pre-mining surface wells drilled into the mine during active mining operations
  - Pre-mining in-mine boreholes drilled into the mine during active mining operations
  - Post-mining gob wells drilled into the mine during active mining operations
  - Surface wells drilled after the cessation of active mining operations
- Mine methane from any well or borehole connected to a non-qualifying destruction device at any point during the year prior to offset project commencement is not eligible for crediting

Abandoned Underground Mine Methane Drainage Activities

- A qualifying destruction device must not have been operational at the mine prior to offset project commencement unless the mine was previously engaged in active underground methane drainage activities and the methane destruction device was considered a qualifying device for those activities
  - Natural gas pipeline injection is not an eligible end use in situations where, when active, the mine injected mine methane into a natural gas pipeline for off-site consumption

Abandoned Underground Mine Methane Drainage Activities

- Multiple mines with multiple mine operators may report and verify together as a single project if they meet the criteria of section 2.4(c) of the MMC Protocol
- Projects must not:
  - Account for virgin coal bed methane extracted from coal seams outside the mine extents or from outside the methane source boundaries
  - Use CO_2, steam, or any other fluid/gas to enhance mine methane drainage
  - Occur at flooded mines or in flooded sections of mines

Early Action Quantification Methodologies for MMC

- Approved early action methodologies:
  - Climate Action Reserve's Coal Mine Methane Project Protocol version 1.0 and version 1.1
  - Verified Carbon Standard VMR0001 Revisions to ACM0008 to Include Pre-drainage of Methane from an Active Open Cast Mine as a Methane Emission Reduction Activity Methodology, v1.0
  - Verified Carbon Standard VMR0002 Revisions to ACM0008 to Include Methane Capture and Destruction from Abandoned Coal Mines Methodology, v1.0.
    - For VMR001 and VMR002, no ARB offset credits will be issued for GHG emission reductions credited by an Early Action Offset Program based on data reported by the Offset Project Operator or Authorized Project Designee that included emissions from the production of power, heat or supply to gas grid replaced by the project activity in the baseline (identified as $BE_{Use,y}$ in ACM0008)

Early Action Quantification Methodologies for MMC

- ARB offset credits may be issued to projects that achieved verified greenhouse gas emission reductions between January 1, 2005 and December 31, 2014
- Early action listing deadline for MMC projects is January 1, 2015

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California Air Resources Board Mine Methane Capture Protocol

American Carbon Registry Webinar

"California Air Resources Board Mine Methane Capture Offset Projects – Listing, Verification and Offset Credit Issuance"

June 11, 2014

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Outline

- MMC Protocol Highlights
- Emission Sources & End Uses
  - Active Underground Mines
    - Ventilation Air Methane (VAM)
    - Methane Drainage Systems
  - Active Surface Mines
  - Abandoned Mines

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Methane Sources for Project Eligibility

- Active Underground Mines
  - Ventilation systems, or pre-mining surface or in-mine wells, and gob wells
- Active Surface Mines
  - Pre-mining surface or in-mine wells, existing CBM wells to be shut in due to mining activities, reactivated abandoned wells, converted dewatering wells
- Abandoned Underground Mines
  - Pre-mining surface or in-mine wells, and gob wells drilled during active mining operations, and surface wells drilled after mine was abandoned

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Eligible End Use Options for CMM

- Pipeline sales: High-quality gas (>90% methane) or must process the gas to remove contaminates (N_2, O_2, CO_2, H_2S, etc.)
  - Only eligible at Surface mines and Abandoned mines that did not have a pipeline project when the mine was active
- Power generation: Low-to-medium quality gas 25-75% methane can be used to generate power often in 1 to 3 MWe containerized Gensets
- Heating: Low-to-medium quality gas can be used for on site boilers or for mine air shaft heating
- Incineration: Low-to-medium quality gas can be destroyed in enclosed flare
- Thermal Oxidation: Methane destruction of ventilation air methane (0.3-1.5% methane)

Quantification Methodology

- Active Underground & Surface Mines
  - Similar to CDM, VCS, and CAR methodologies (baseline emissions - project emissions = emission reductions)
    - Monitoring equipment includes gas flow meter, methane analyzer, etc. (VAM projects measure exhaust gas)
    - Methane GWP = 21 (for now), ARB emission factors, uncombusted methane (not biogenic), standard conditions, destruction efficiencies
    - Subtract non-qualifying devices (pre-2007, pipeline gas)
- Abandoned Underground Mines
  - Uses a single default hyperbolic emissions rate decline curve for all U.S. mines (sealed and vented) or a site-specific decline curve for vented mines
  - Additional uncertainty deduction (20%) applies *unless*:
    - Utilized methane drainage system when active
    - Using baseline based on measured data from existing wells

Important Dates

- Protocol Approved April 25, 2014 and effective July 1, 2014
- Early Action Projects in CAR and VCS must be listed in ARB by December 31, 2014
- Project Commencement Date
  - After January 1, 2007, unless registered in an Early Action program
  - Within 9 months of first destroying methane
    - (maximum “Initial start-up period”)
- Ten Reporting Periods
  - First Reporting Period can be 6-24 months
  - Remaining reporting periods must be 12 months

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Information Needed for Project Listing and Verification

- Methane gas ownership
  - Rules different between public vs. private lands
  - Environmental attributes may not be mentioned
- Mine lease areas
  - Updated periodically
  - Boundaries for pre-mining wells
- Mine maps
  - Updated monthly
  - Show mined-out areas, sections planned to be mined, locations of shafts and borehole/wells
- MSHA classification
  - Mine Data Retrieval System http://www.msha.gov/
- Well classifications
  - API#, State O&G databases, well permits, drilling logs

Active Underground Mines

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Methane Emission Sources at Active Underground Mines

- Pre-mining drainage and sales
  - 90+% methane (high quality)
  - generally high quality gas can be sold to pipelines, but could be used for heat or power generation
- Ventilation air methane (VAM) oxidation
  - <2% methane (low quality)
  - Low grade heat may be gainfully used
- Gob gas capture and utilization
  - 20-80% methane (medium quality)
  - gob gas with greater than 25% methane can be used for power or heat generation or flared

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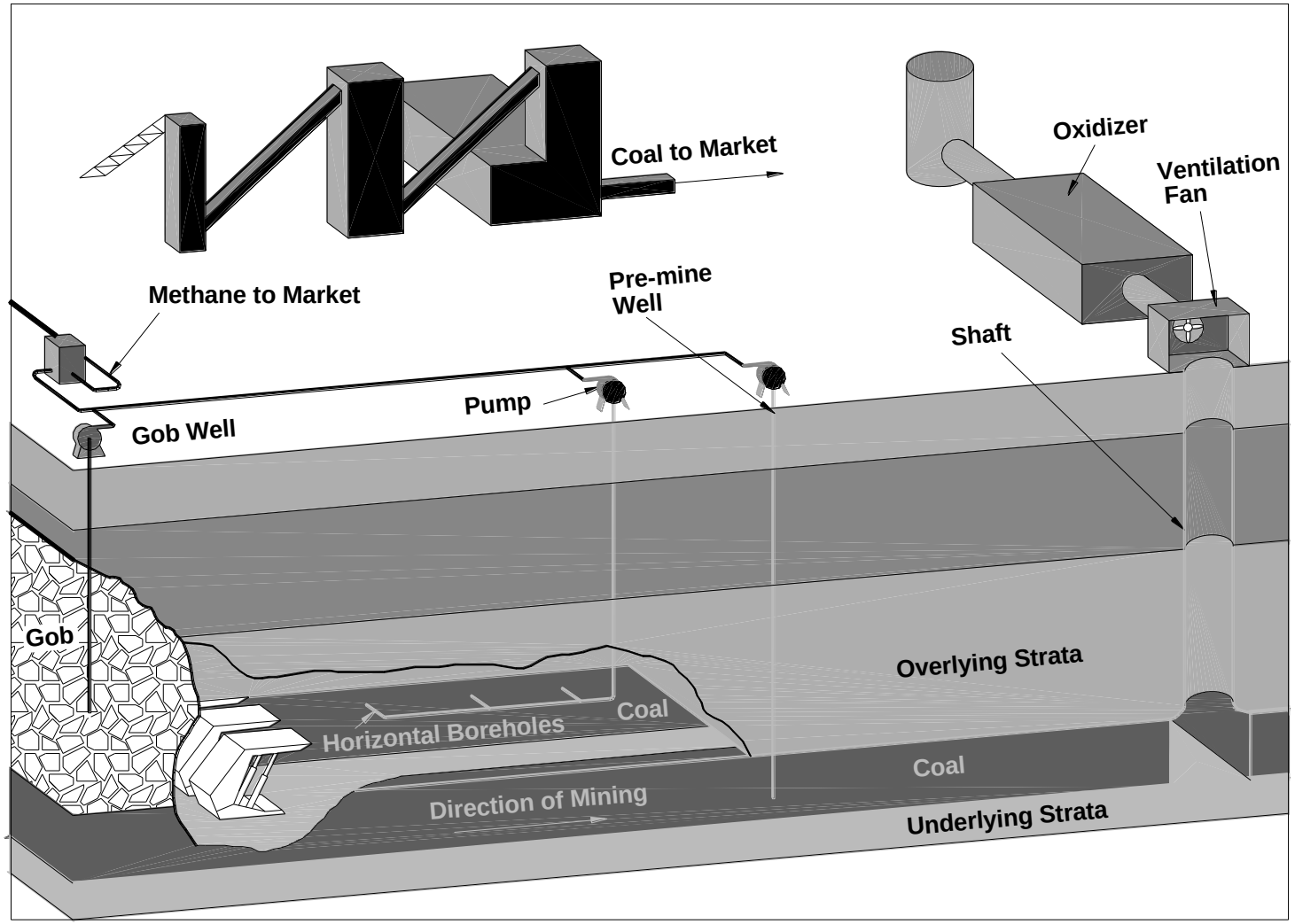
Capturing VAM & CMM



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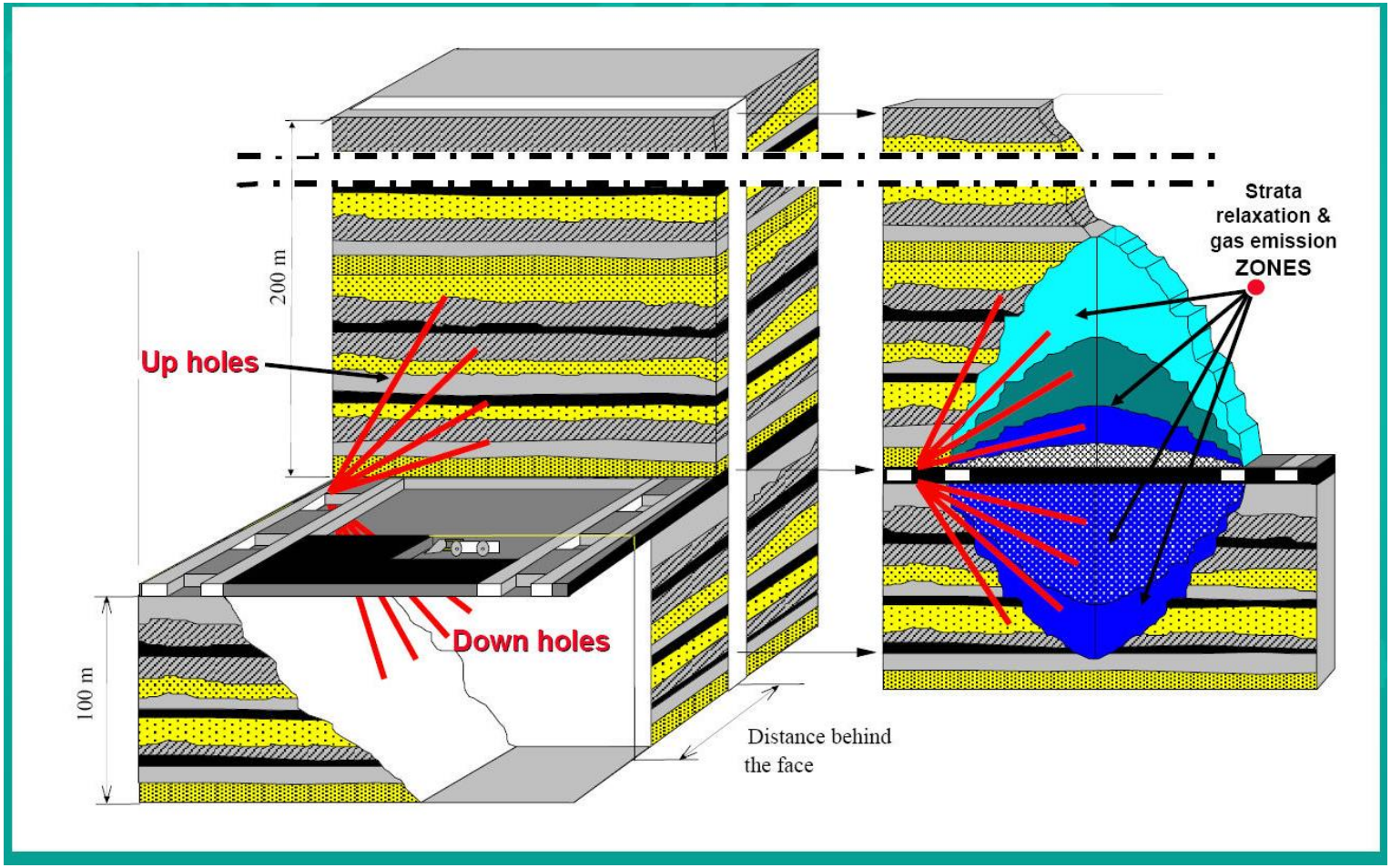
Capturing Underground CMM from In the Mine



Projects at Active Underground Mines

- Protocol allows for multiple Projects at a single mine based on differing methane sources (shafts, wells, boreholes) or different qualifying destruction devices (electric power, boilers, flare, etc.)
  - May lead to more complex monitoring and metering
  - Projects must be registered separately
    - Could have separate concurrent verifications, but not a "joint project verification" as previously allowed by CAR

Methane Activities Allowed in MMC Protocol

- VAM Projects
  - New ventilation shaft connected to existing or new qualifying device may be either project expansion or new project
  - Existing ventilation shaft connected to existing or new qualifying device may be either project expansion or new project
  - New qualifying device added to existing vent shaft currently connected to a qualifying device is considered a new project

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VAM Project

VAM destruction units located at McElroy Mine in Pennsylvania

Methane Activities Allowed in MMC Protocol

- Active Underground Project
  - Newly drilled well/borehole connected to existing or new qualifying device may be either project expansion or new project
  - Existing well/borehole connected to existing or new qualifying device may be either project expansion or new project
  - New qualifying device connected to existing well/borehole currently connected to a qualifying device is considered a new project
  - Methane from well/borehole connected to a non-qualifying device during year prior to offset project commencement date is not eligible for crediting
- These four activities also apply to Surface and Abandoned Mine Methane Drainage Projects

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Active Underground Mine Project

Vessels Coal Gas 3 MWe gensets and enclosed flare in Colorado

Active Surface Mines

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Methane Emission Sources at Active Surface Mines

- Methane emissions sources can include:
  - Coal excavated & processed
  - Coal stored on site in piles
  - Coals, sandstones, shales in over-and under burden *(only source of methane recovery)*
- Capturing and utilizing methane before mining activities encroach can capture a portion (20-40%) of these fugitive emissions

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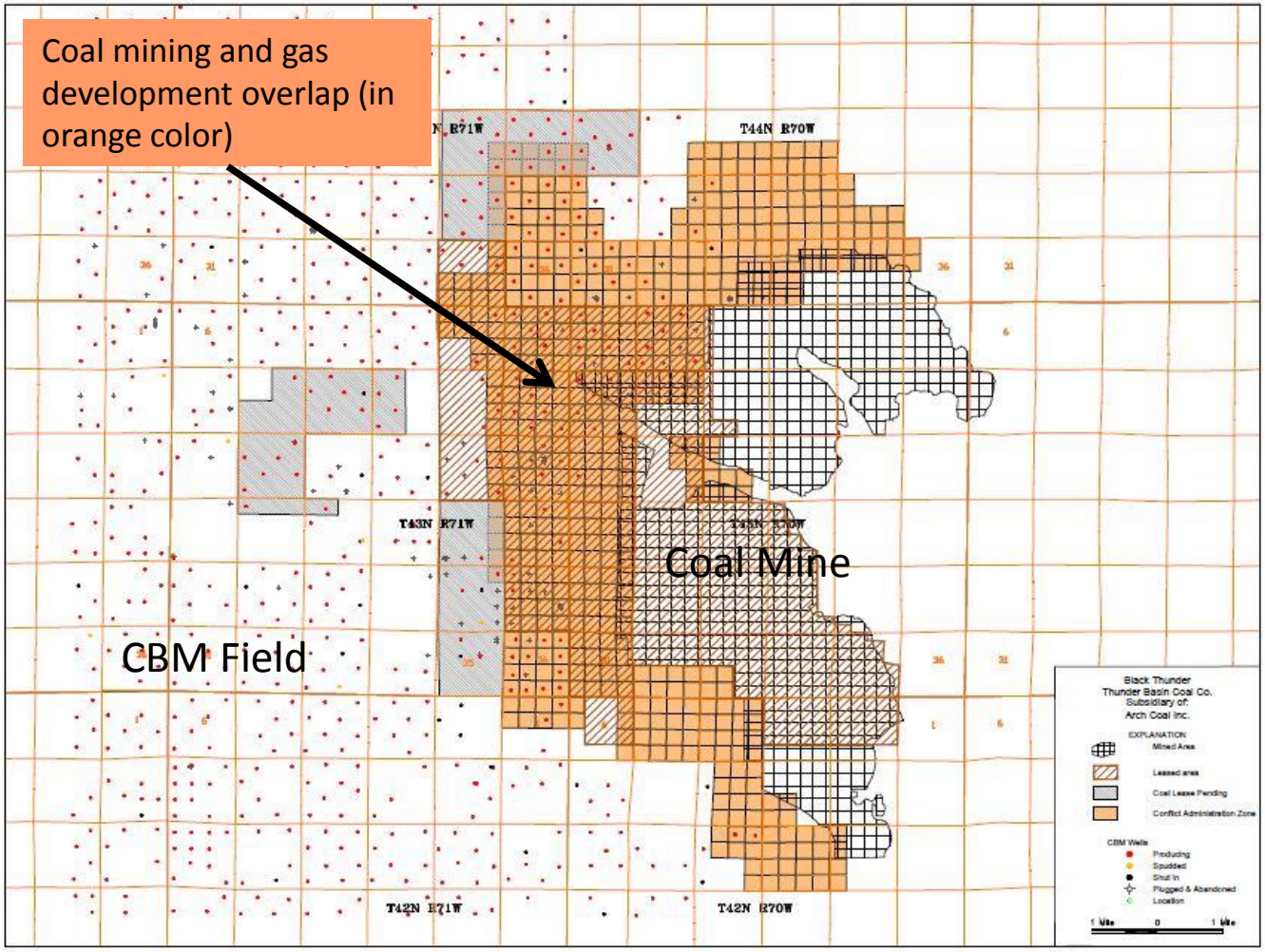
Pre-mine Methane Drainage Wells



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Surface Mine Methane Quantification Methodology

- Baseline Emissions from release of methane (BE_{MR} term) are only accounted for during the reporting period when the well:
  - Is physically mined through
  - Produces elevated levels of atmospheric gases (nitrogen increases by at least five fold compared to baseline levels)
- Project Emissions including CO_2 emissions from the destruction of methane that took place during the reporting period regardless of whether or not the well is mined through
- Same scenario applies for pre-drainage wells at active underground mines

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Abandoned Underground Mines

Abandoned Mine Methane Quantification Methodology

- Projects with multiple mines can be verified together as a single project
  - Aggregate mine baselines
  - Metered at a centralized point
- Vertically separated mines over- or under-lying each other can use well completed in one mine to capture methane in other mines
  - Must be within the maximum vertical extent of strata (150 meters above and 50 meters below each mine)

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Baseline Methodology for Abandoned Mines

- Use a decline function as an expression of the pressure loss in the system through time as more methane is emitted to the atmosphere
- As the adsorption pressure in coal decreases in relationship to the atmospheric pressure the rate of methane loss decreases
- Factors include:
  - Total coal thickness
  - Extent of mining area
  - Original gas content of the coal
  - Percent methane in the adsorbed gas

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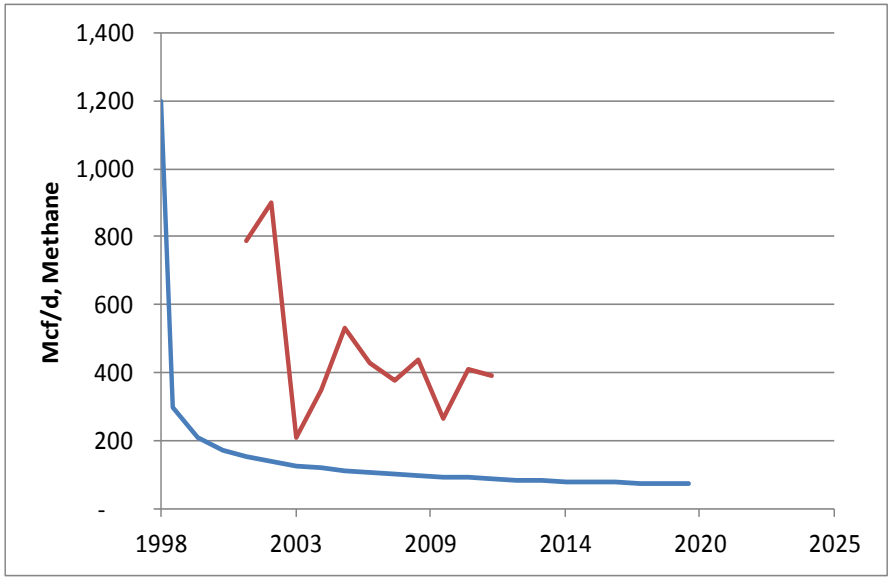
Baseline Emissions From Abandoned Underground Mines

- Equation 5.43 uses the minimum of the hyperbolic decline curve vs. actual methane production for determining baseline emissions
- Equation 5.39 applies a “UD” term (0.8) to default decline curve
- Project emissions must include all methane captured and destroyed (red line)



Example of baseline decline curve (blue) together with actual mine methane production (red)

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Abandoned Mine Project

CMM gas processing plant at Walter Energy project in Alabama

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MMC Project Listing, Verification, and Credit Issuance

Eric Ripley
ACR Program Manager
June 11, 2014

Project Listing

- OPO and APD (if applicable) must first register with ARB –Have CITSS account in good standing
- Listing form must be submitted to ACR with all information included in Section 7.1 of MMC Protocol
- Projects with commencement date on or after January 1, 2015 must submit listing form to ACR within one year of project commencement

Offset Project Reporting

- Initial reporting period may be 6 to 24 months in length – all subsequent reporting periods are 12 months
- Offset Project Data Report (OPDR) must be submitted to ACR within 4 months of the conclusion of each reporting period and prior to verification site visit
- OPDR must include all information found in Section 7.2 of the MMC Protocol

Verification

- Must be performed by ARB-accredited Verification Body
- Schedule
  - If ≥ 25,000 MT GHG reductions for reporting period, verification is performed on 12 month basis (covering one OPDR)
  - If < 25,000 MT GHG reductions for reporting period, verification may be performed on two consecutive reporting periods (i.e. covering two OPDRs)
- Prior to providing any verification services, VB must assess potential for any conflict of interest
  - VB submits Evaluation of Conflict of Interest for Offset Projects form to ACR
- Notice of Offset Verification Services form – VB submits to ACR & ARB 30 calendar days prior to beginning verification services
- Offset verification statement must be received by ACR/ARB within 11 months of conclusion of reporting period
- Things to keep in mind:
  - Verification services may not begin until reporting period has closed
  - OPDR must be submitted prior to verification site visit
  - Expansive VB reporting requirements
  - Verification body rotation

Registry Offset Credit Issuance

- Following completion of verification, ACR will review verification documents/request additional information from OPO/APD/VB to ensure that project/verification met applicable regulatory requirements
  - Initial determination on credit issuance within 45 calendar days of positive/qualified positive OVS submittal
  - If credits are initially denied, OPO/APD can petition for additional review – final determination within 30 calendar days

- ACR will issue one Registry Offset Credit (ROC) for each MT $CO2_e$ GHG emission reduction/removal enhancement

ARBOC Issuance

- Once ROCs issued, OPO/APD submits ARB Request for Issuance of ARB Offset Credits form

- ARB will conduct review of listing information, OPDR(s), and verification reporting
  - Determination on whether regulatory requirements are met within 45 calendar days of receiving complete and accurate information
  - If ARBOCs initially denied, OPO/APD can petition for review – final determination by ARB within 30 calendar days

- Upon acceptance of OVS, ARBOCs issued for each MT $CO2_e$ GHG emission reduction/removal enhancement
  - Prior to ARBOC issuance, ROCs are cancelled from ACR project registry

Invalidation

- ARB may invalidate ARB offset credits within 8 years of issuance due to the following:
  - OPDR contains material misstatement
  - Regulatory violations during the RP
  - Offset credit issuance for the same project and reporting period in multiple offset programs
- For MMC projects, invalidation statute of limitations is reduced in the same way as for forestry and livestock projects
- To reduce invalidation timeframe from 8 years to 3 years:
  - Verification of a subsequent OPDR conducted by a different VB than the one that performed most recent verification

Invalidation Example

In below example, verification body rotation requirements and reduction of invalidation statute of limitations timeframe to 3 years is accomplished by switching VBs every 3 years

ARBOC Issuance Year	OPDR Year	VB	Initial Invalidation Statute of Limitations	Reduced Invalidation Statute of Limitations
2014	2014	1st VB	8	0 years in 2017
2015	2015	1st VB	8	1 year in 2017
2016	2016	1st VB	8	2 years in 2017
2017	2017	2nd VB	8	0 years in 2020
2018	2018	2nd VB	8	1 year in 2020
2019	2019	2nd VB	8	2 years in 2020
2020	2020	3rd VB (could be the 1st VB again given that 3 years would have passed in this example)		

Questions?

ACR@winrock.org: Will be directed to the ACR Administrator

Technical questions related to protocols, verification:

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Thank You!