

Coal Mine Methane: US Update



Pamela M. Franklin

US Environmental Protection Agency

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US Environmental Protection Agency



- **Coalbed Methane Outreach Program**
 - Voluntary program has promoted recovery and use of coal mine methane since 1994
- **US CMM industry is robust**
 - ~ 80% of methane from US coal mine degasification systems is recovered and used
 - In 1993, only ~ 25% was recovered and used
- **US EPA collaborates with industry, private sector to promote CMM projects**
 - Provide information about potential opportunities at US mines (active and abandoned)
 - Provide tools, end-use assessments, technical and economic analyses
 - Supported technology demonstration of VAM abatement



Outline

- Background: US EPA
- US EPA “Endangerment Determination”
- US climate policy and its role in coal mine methane project development
- US CMM emissions and opportunities



US EPA's "Endangerment" Determination

- April 2, 2007– In *Massachusetts v. EPA*, the Supreme Court found that greenhouse gases are air pollutants covered by the Clean Air Act
- EPA was required determine whether:
 - GHG emissions from new motor vehicles cause or contribute to air pollution;
 - This air pollution may reasonably be anticipated to endanger public health or welfare; or
 - The science is too uncertain to make a reasoned decision



US EPA's Endangerment Findings

- December 7, 2009 –Administrator issued two distinct findings regarding greenhouse gases under section 202(a) of the Clean Air Act
 - **Endangerment Finding:** Current and projected concentrations of the mix of six key greenhouse in the atmosphere threaten the public health and welfare
 - **Cause or Contribute Finding:** Combined emissions of CO₂, CH₄, N₂O, and HFCs from new motor vehicles and motor vehicle engines contribute to the atmospheric concentrations of these key greenhouse gases, and hence to the threat of climate change
- As part of development of final finding, EPA did a comprehensive review of the science
 - 380,000 public comments; 11,000 significant
 - Many raised issues with the science and provided literature
 - Response to Comments document thoroughly addresses all comments



The Public Health and Public Welfare Elements of the Endangerment Findings

- Public Health

“The Administrator has considered how elevated concentrations of the well-mixed greenhouse gases and associated climate change affect public health by evaluating the risks associated with changes in air quality, increases in temperatures, changes in extreme weather events, increases in food- and water-borne pathogens, and changes in aeroallergens.”

“Finally, the Administrator places weight on the fact that certain groups, including children, the elderly, and the poor, are most vulnerable to these climate-related health effects.”

- Public Welfare

“The Administrator has considered how elevated concentrations of the well-mixed greenhouse gases and associated climate change affect public welfare by evaluating numerous and far-ranging risks to food production and agriculture, forestry, water resources, sea level rise and coastal areas, energy, infrastructure, and settlements, and ecosystems and wildlife.”



Endangerment Petitions

- EPA received 10 administrative petitions for reconsideration for the Endangerment Findings.
- With this decision, EPA decided there was no scientific or other basis to change its 2009 finding that climate change caused by emissions of greenhouse gases threatens public health and the environment.
- Petitions were denied July 29, 2010.

“The endangerment finding is based on years of science from the U.S. and around the world. These petitions -- based as they are on selectively edited, out-of-context data and a manufactured controversy -- provide no evidence to undermine our determination. Excess greenhouse gases are a threat to our health and welfare.”

-- EPA Administrator Lisa P. Jackson

US Climate Policy

- US Congress has not yet passed comprehensive climate change legislation, but passing climate legislation remains a priority for the Administration.
- EPA is already working to regulate greenhouse gas emissions through the Clean Air Act – the law that authorizes EPA to regulate all other air pollutants.
 - EPA established the Greenhouse Gas Reporting Program to collect annual emissions data from large facilities.
 - The reporting program will cover more than 85 to 90% of total US greenhouse gas emissions.
 - EPA will receive the first annual reports in March 2011.
 - Gassy underground coal mines are included and must monitor beginning in 2011, with first reporting in March 2012.
 - These data will assist in the development of future climate policies.
 - EPA finalized regulations in 2010 affecting businesses planning to build new, large facilities or make major expansions to existing facilities.
 - EPA set greenhouse gas emission standards for new cars and light duty trucks for model years 2012 – 2016.



US federal government role in CMM project development

- Some legislative proposals include CMM as potential offsets under a national “cap and trade” greenhouse gas emissions control program.
- Federal tax incentives for CBM/CMM gas production have expired.
- There is federal funding (e.g., Department of Energy) for research and development on carbon capture and sequestration, fossil energy exploration and production

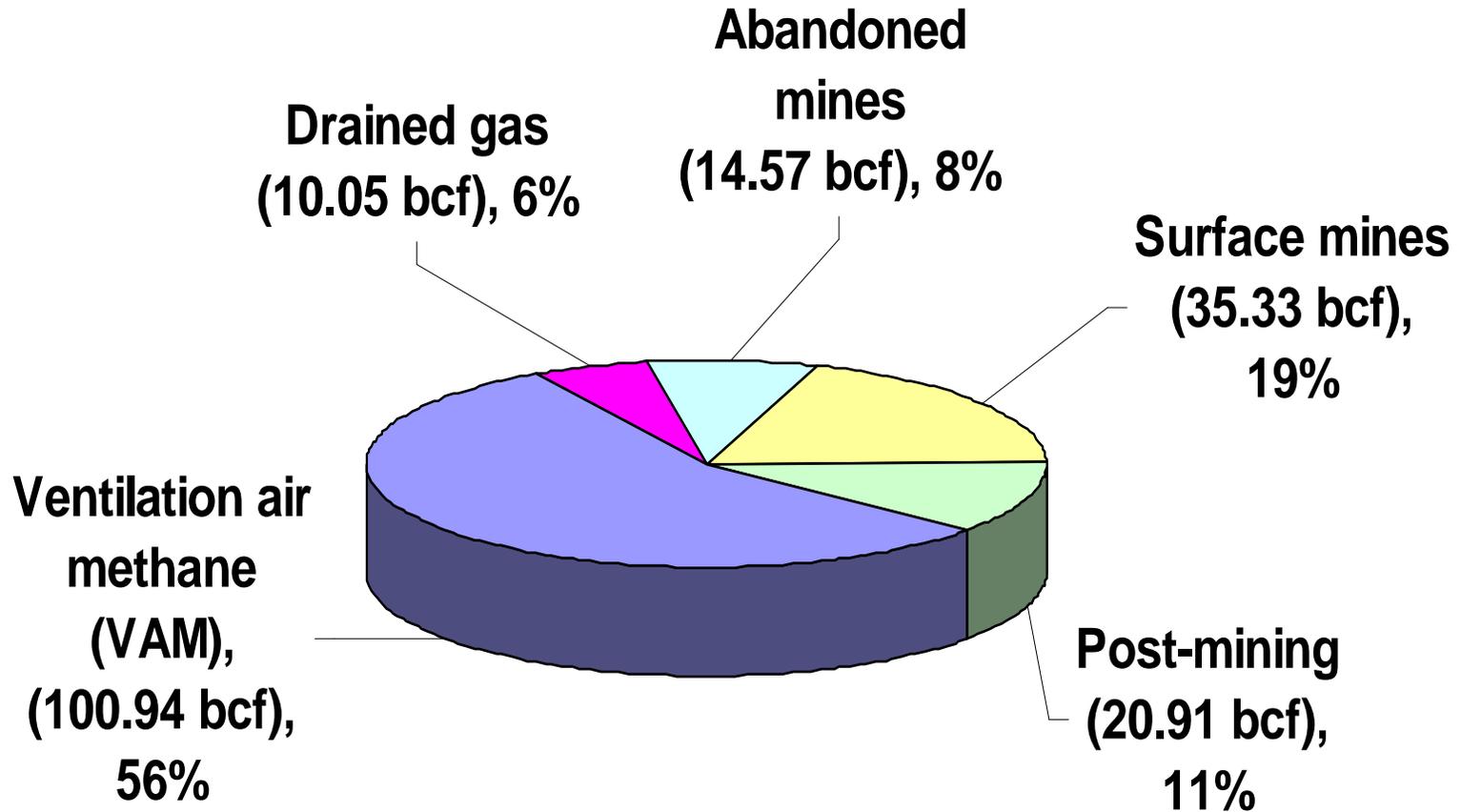


US legal framework for CMM project development

- On Federal lands (much of western US), federal government owns mineral leases (coal, oil, gas).
 - Oil & gas estates are separate from coal estate, so the right to use CMM is not automatically granted to the coal mine.
 - Currently, there is no regulatory policy requiring or encouraging CMM to be used or destroyed
- On private (“fee”) lands, ownership of coal seam gas depends on laws of each state.
 - Several states have enacted legislation to clarify ownership.
 - Many disputes are resolved through legal challenges and negotiations.



2008 U.S. CMM Emissions



Total CMM emissions: 181.8 Bcf

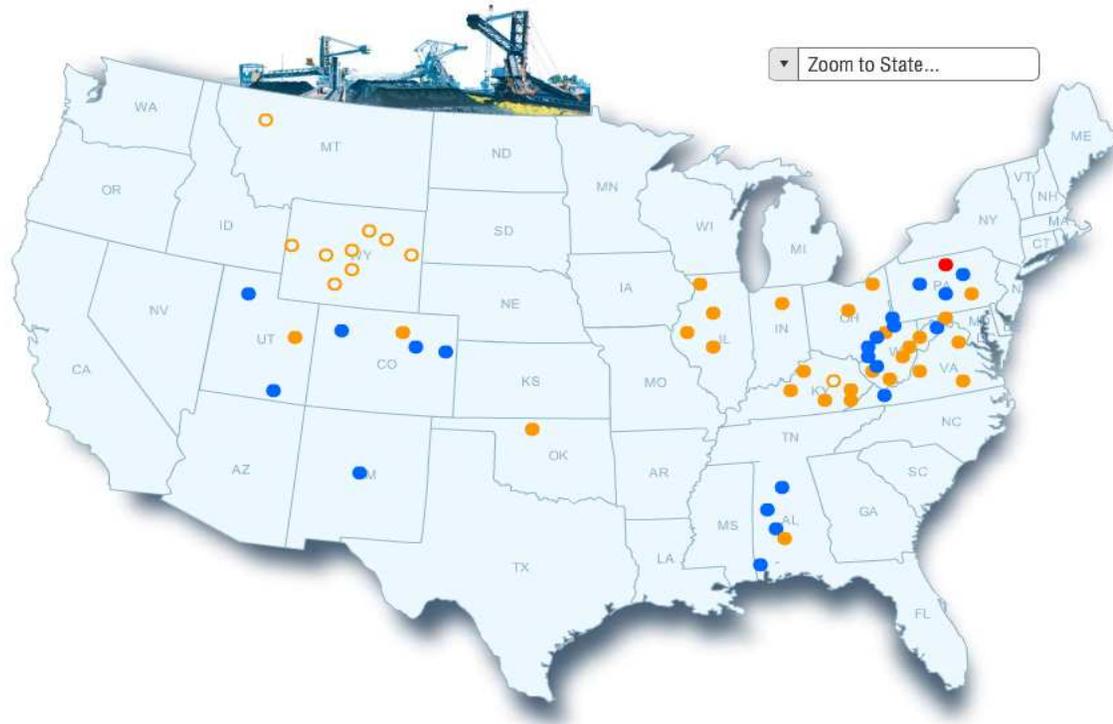
United States: Existing CMM Projects

- **CMM recovered and utilized (2008)**
 - 44.4 Bcf - equal to 20 MMTCO₂e “emissions avoided”
- **Active Underground Mines: projects at 14 mines**
 - Total recovered and used: 37 Bcf
 - All projects use gas from drainage (degas) systems
- **Abandoned Mines: projects at about 30 mines**
 - Total recovered and used: 7.7 bcf
- **Surface Mines: project in Powder River Basin**
 - Estimated recovered emissions = 3.7 bcf (2006 – 2009)



Examples of U.S. Projects

Coal Mine Methane Recovery at Active U.S. Coal Mines Current Projects and Potential Opportunities

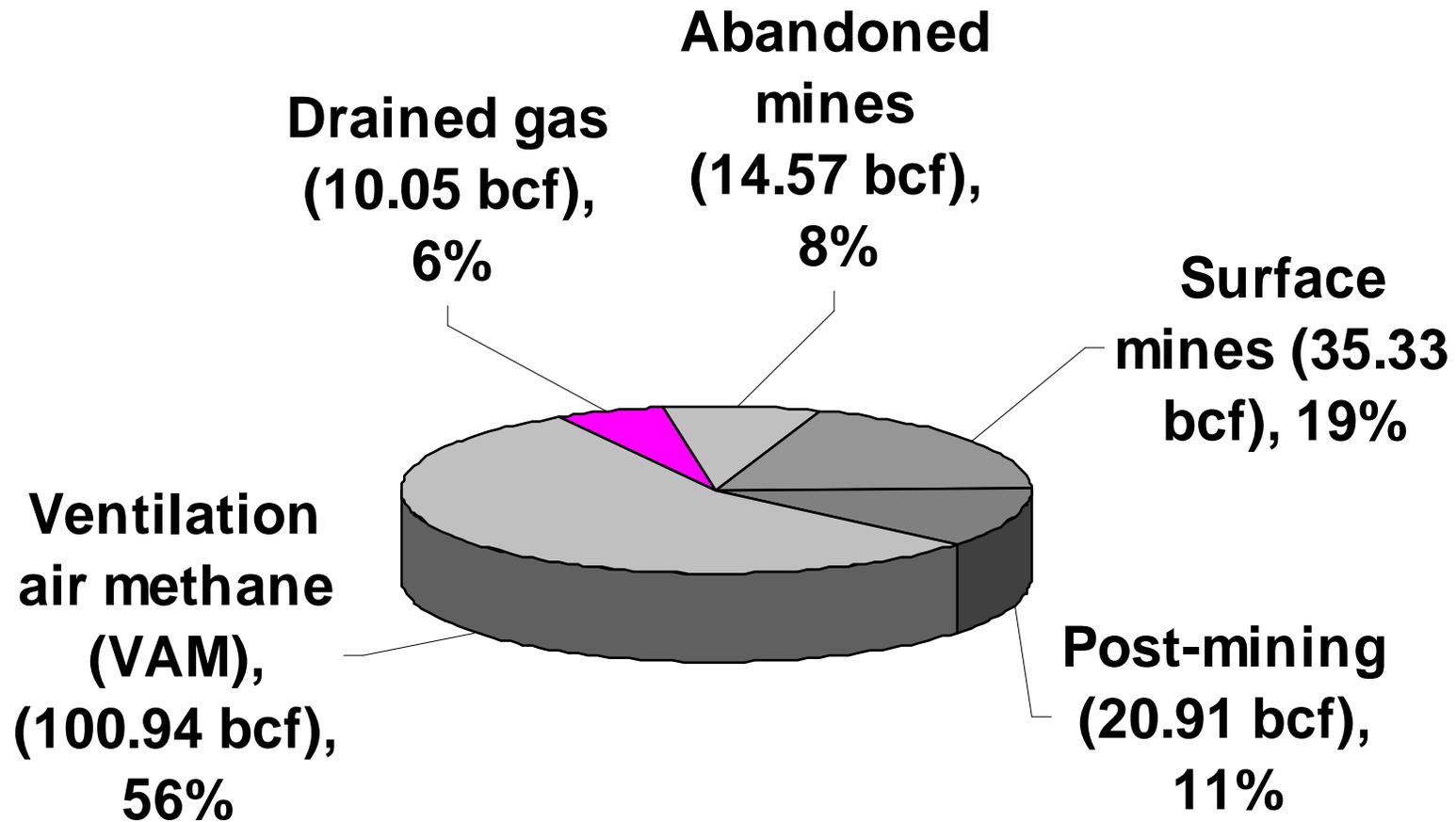


- Drainage system with methane recovery
- Drainage system with no recovery
- No drainage system
- Underground
- Surface

To view mines selectively, click on the desired category. Hit ESC to see all.



Active Underground Mines: Drainage Systems

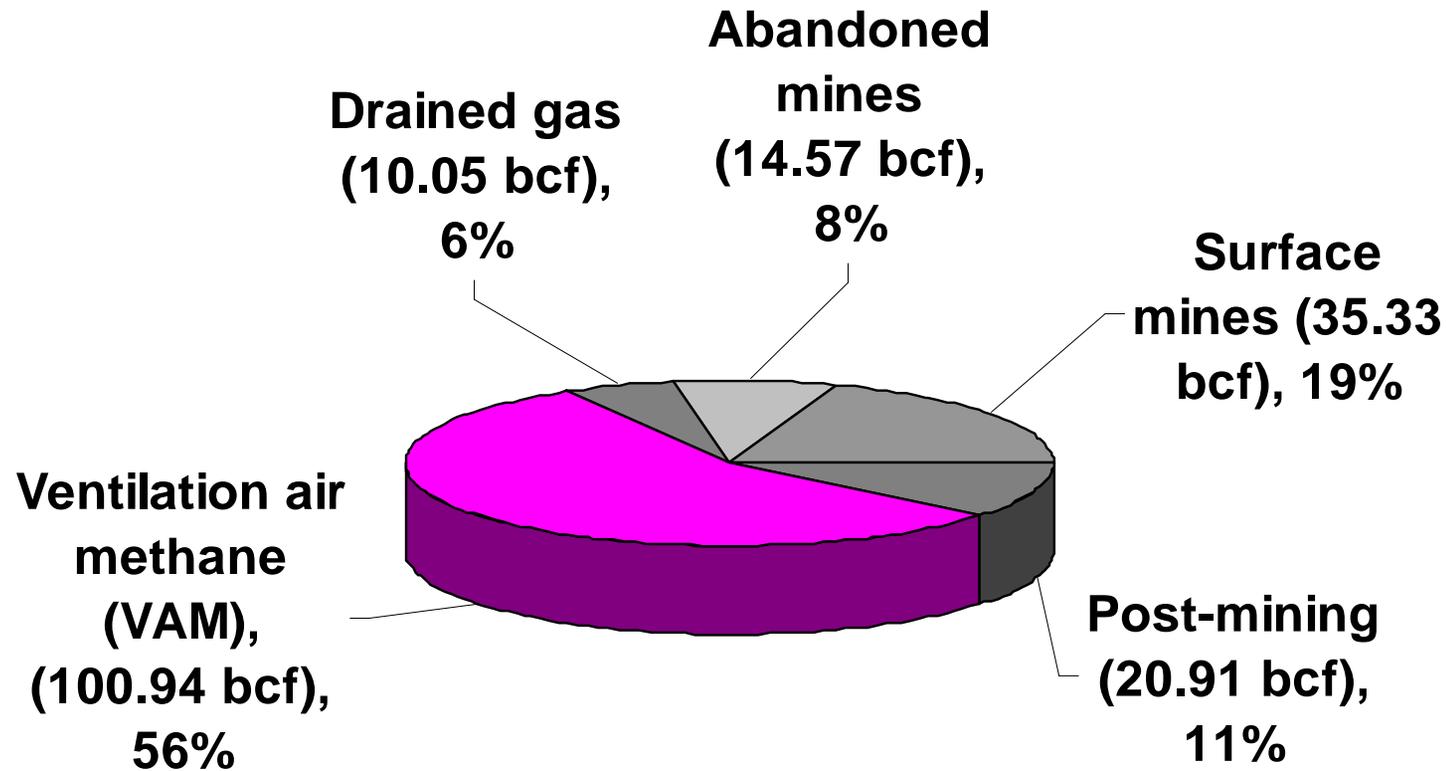


Active Underground Mines: Drainage Systems

- “Low-hanging fruit”:
 - ~ 10 Bcf emitted from drainage systems (2008) available for utilization
- >23 US mines currently use drainage systems
 - More mines could install a drainage system to augment their ventilation system
 - New systems may be installed as mines get deeper, more gassy
- Challenges (especially in western US):
 - Gas ownership / rights are unresolved on federal lands
 - Rugged terrain, limited access to pipeline, regulatory restrictions



Active Underground Mines: VAM



Active Underground Mines: VAM

- US VAM emissions: 101 Bcf (2008)
- “Rules of thumb” for economical oxidation projects:
 - Minimum 0.6% methane concentration
 - Drained gas can be blended in to boost lower methane concentrations
 - Ideally, ~0.9% for maximum output and revenue
- EPA has developed a summary of data on mine shaft methane concentrations for 39 gassy US mines
 - Based on MSHA data for 2008-2009
 - Data illustrates variability for exhausts with >0.3% methane
 - 24 exhausts at 16 mines appear to have good potential for VAM mitigation projects (methane concentrations >0.8%)
 - Before project development, site-specific measurements would be needed



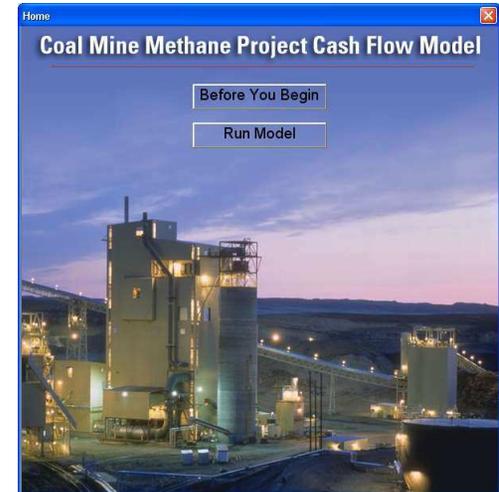
US VAM Mitigation Activities Underway

- Technology demonstrations using thermal oxidizers completed or underway
 - CONSOL Windsor Mine (closed) (MEGTEC vocsidizer)
 - JWR Mine No. 4 (Biothermica VAMOX)
- New projects announced
 - CONSOL McElroy mine in WV (Durr Ecopure technology) – to go online in the second quarter of 2011
 - CONSOL Enlow Fork mine in PA – operational late 2010

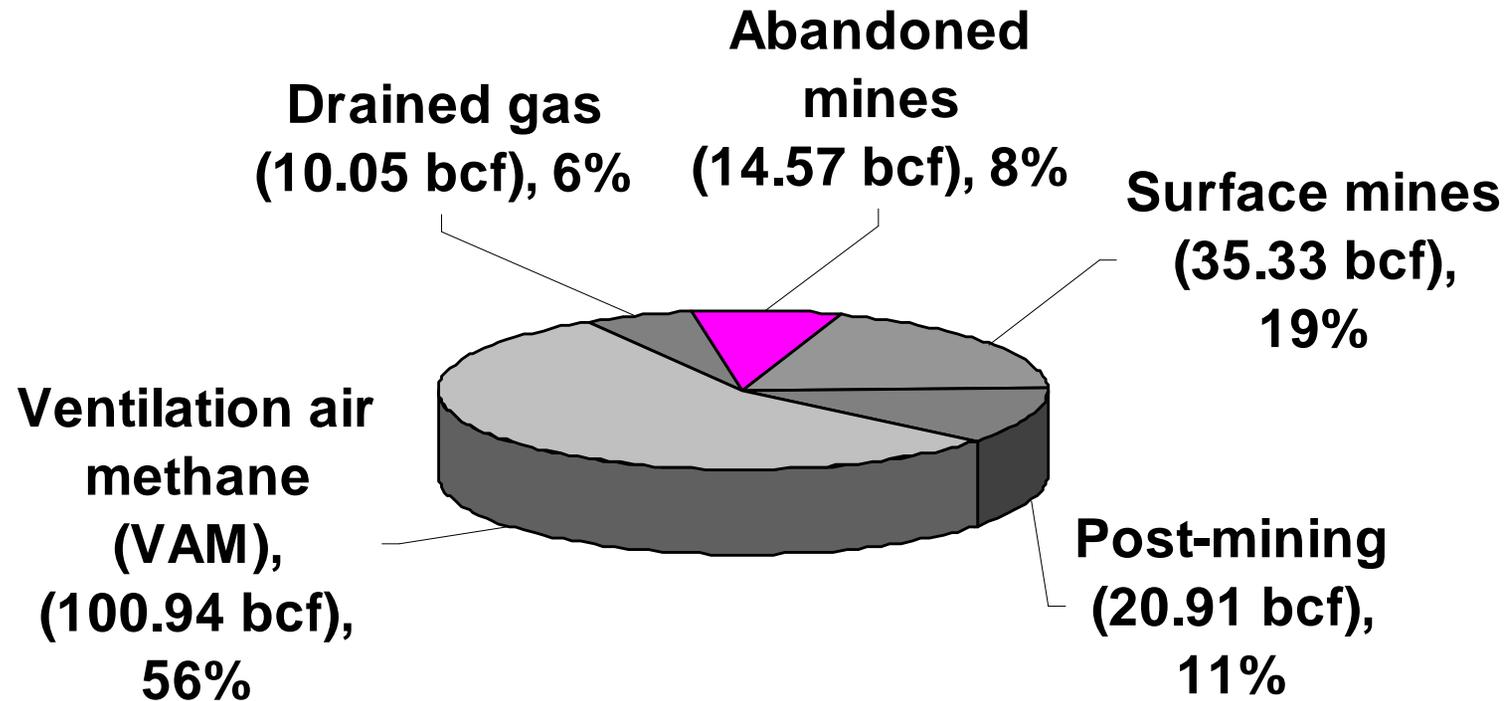


CMOP VAM Resources

- CMOP's Project Cash Flow Model Tool
 - Version 2.0 with new VAM modules under development
- CMOP resources online:
 - [VAM Measurement Methodologies](#)
 - [US VAM exhaust shaft characterization](#)
 - [VAM Technologies Overview](#)



Abandoned Underground Mines

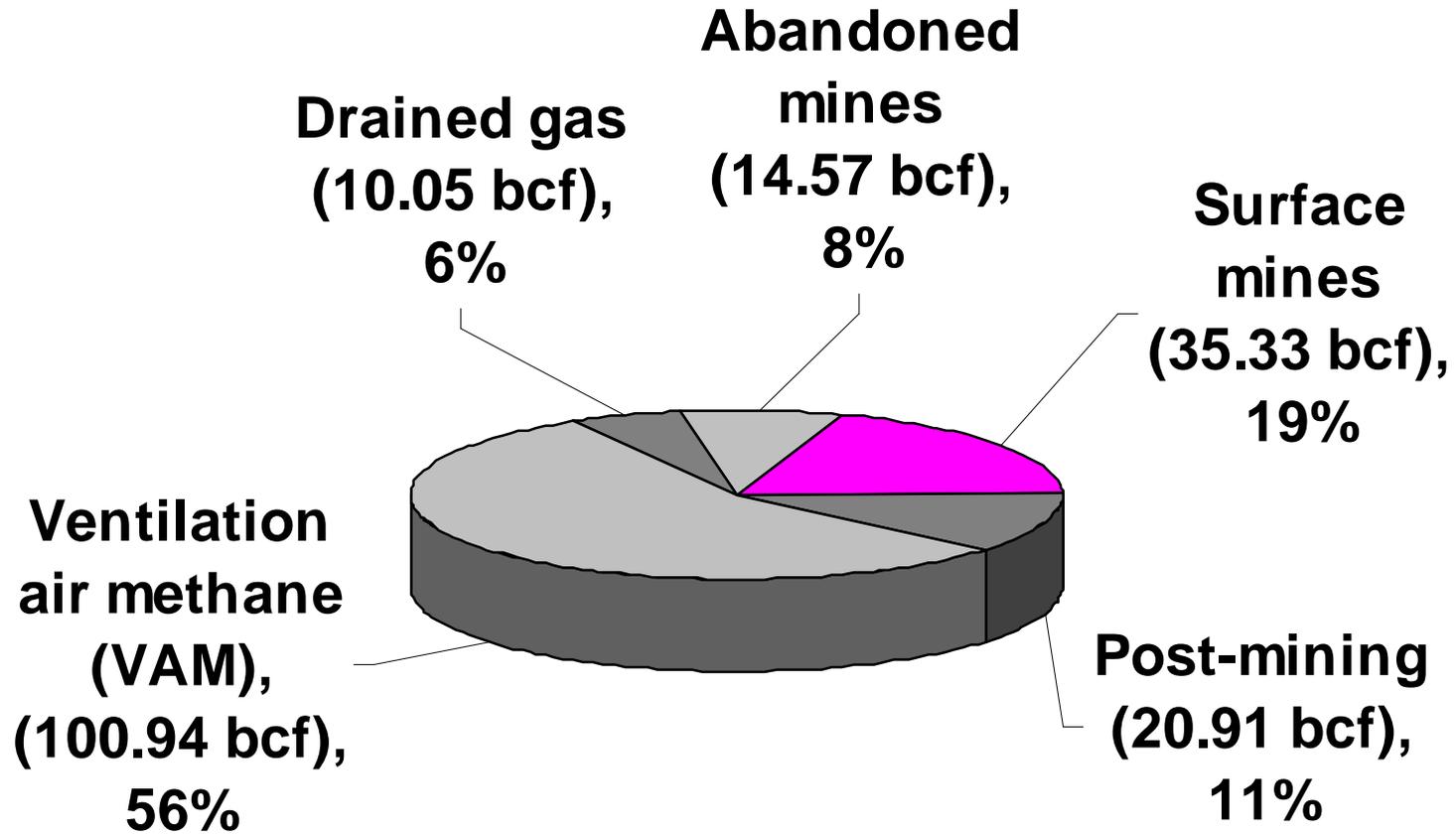


Abandoned Underground Mines

- 14.6 Bcf emitted (available) in 2008
 - Additional mines closed every year
 - EPA has developed database of project opportunities at 400 abandoned mines
- Challenges:
 - Identifying owners of mine / gas / surface and acquiring rights, especially mines closed before 1972
 - Predicting future gas resources over time and status of mine (e.g., fully or partially flooded)
 - Location sometimes remote: market access, end-use



Surface Mines



Active Surface Mines

- 35.3 Bcf emitted from surface mines in 2008
- Powder River Basin (PRB) produces > 50% of all surface-mined coal in U.S.
 - Thick seams, very permeable coal
 - Extensive pipelines and other infrastructure
 - Pre-mine drainage and recovery project at North Rochelle Antelope mine is registered with VCS, producing carbon credits
- Challenges:
 - Limited information on current activities, future opportunities
 - Distinction between CBM and CMM may be unclear
 - Ownership issues: different parties, difficult to coordinate



Thank you!

US EPA Coalbed Methane Outreach Program

www.epa.gov/cmop

Ms. Pamela Franklin

franklin.pamela@epa.gov

+ 1.202.343.9476

