

Measurements of Methane and Ethane Emissions from Surface Casing Vents and Surrounding Soils of Oil and Gas Wells

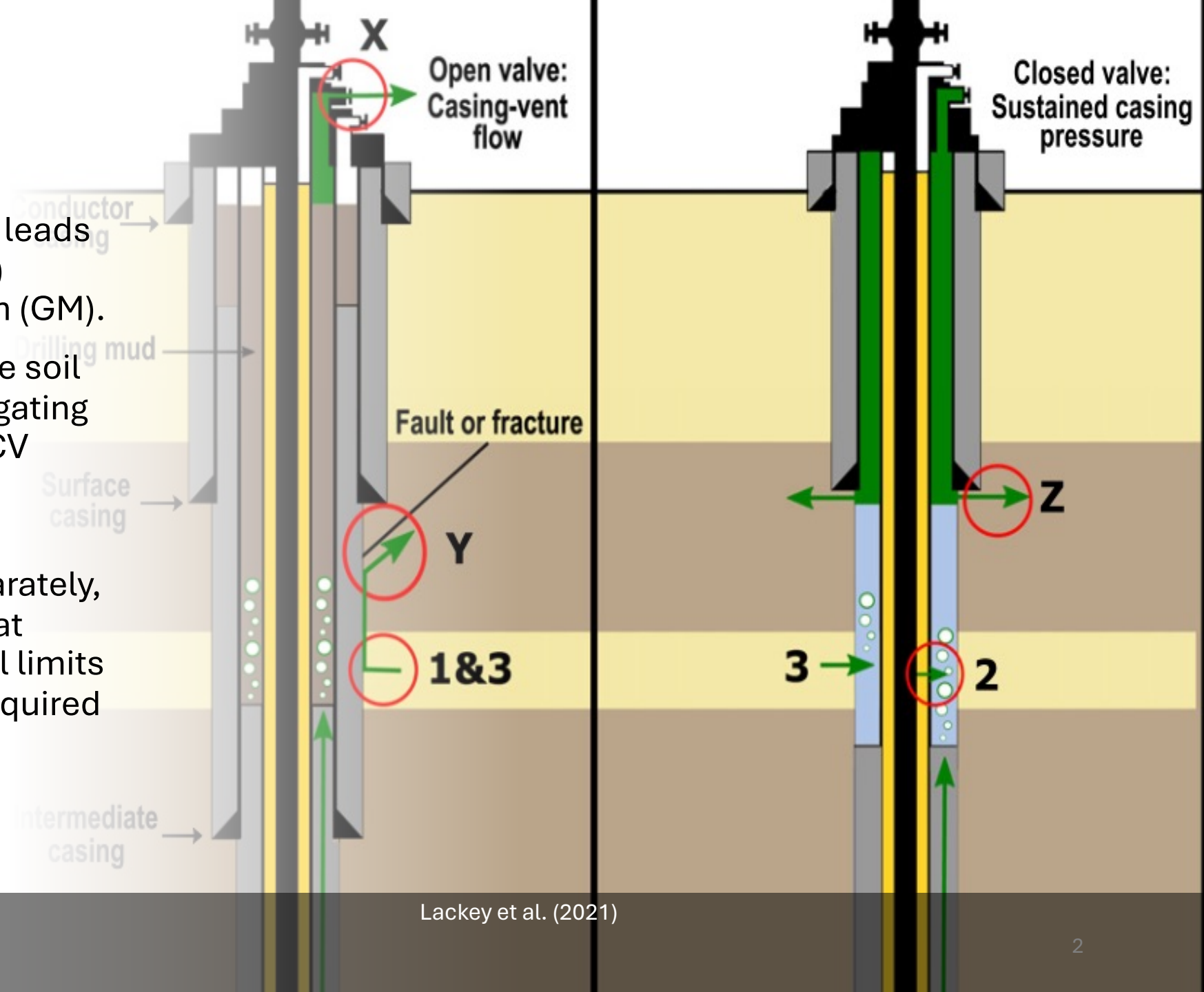
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Introduction

- Compromised well integrity leads to surface casing vent (SCV) emissions and gas migration (GM).
- Studies measuring GM at the soil surface, and studies investigating the relationship between SCV flows and GM through field measurements are limited.
- Regulation treats them separately, binary limits presuppose that effects are limited, seasonal limits on work, volumetric rates required only for SCVF



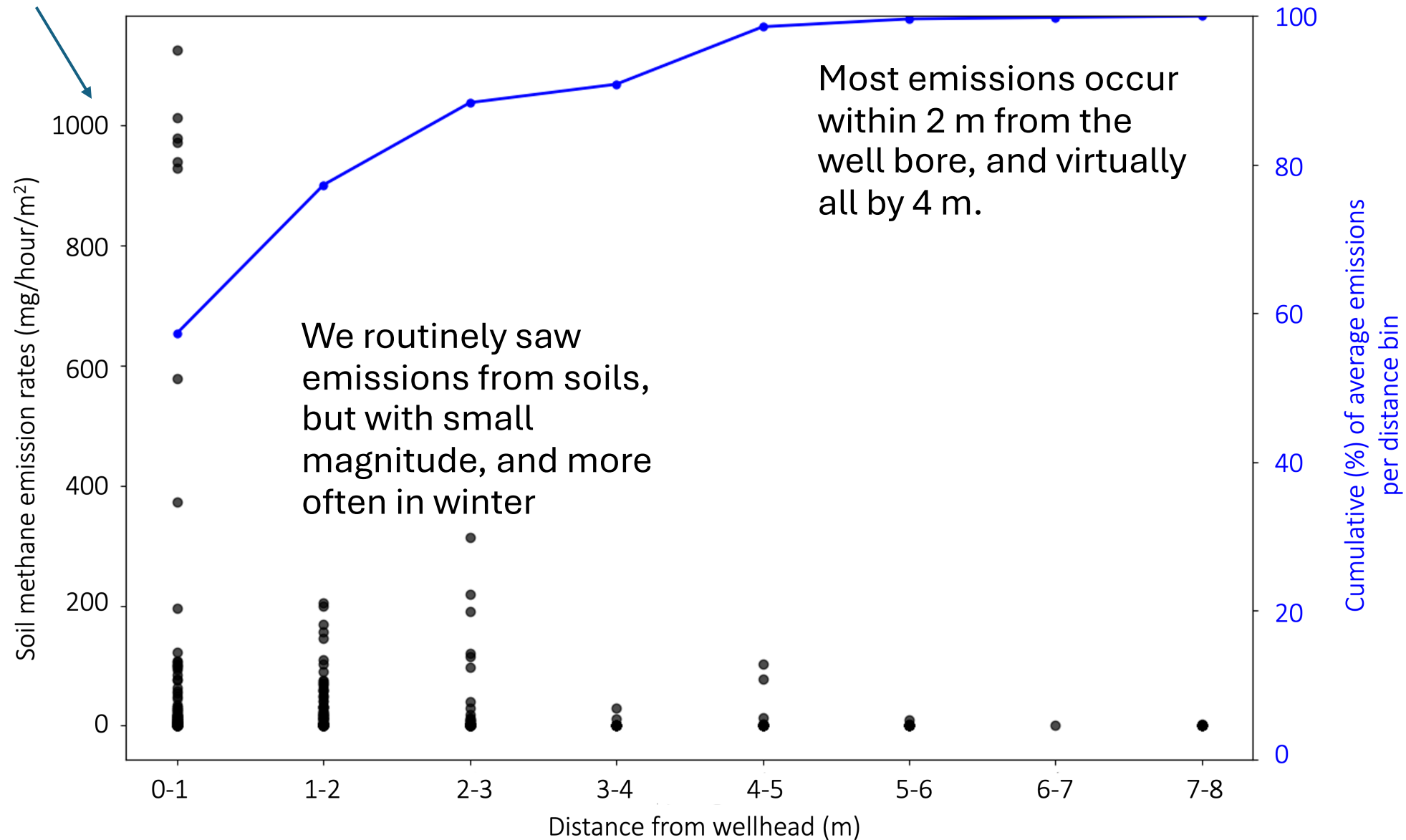
Methods

- Developed and validated a low cost and fast (180s) in-situ automatic chamber system for methane and ethane volumetric measurements, that can be used in all seasons
- Chamber is much more sensitive than current methods – will “see” much more
- Used automatic static chambers to conduct 1241 soil emission measurements (1087 include ethane) in numerous regions across Alberta
- Measurements in summer and winter
- Indications of surface casing vents for leakage - super-ambient (not bubble test) or in AER log

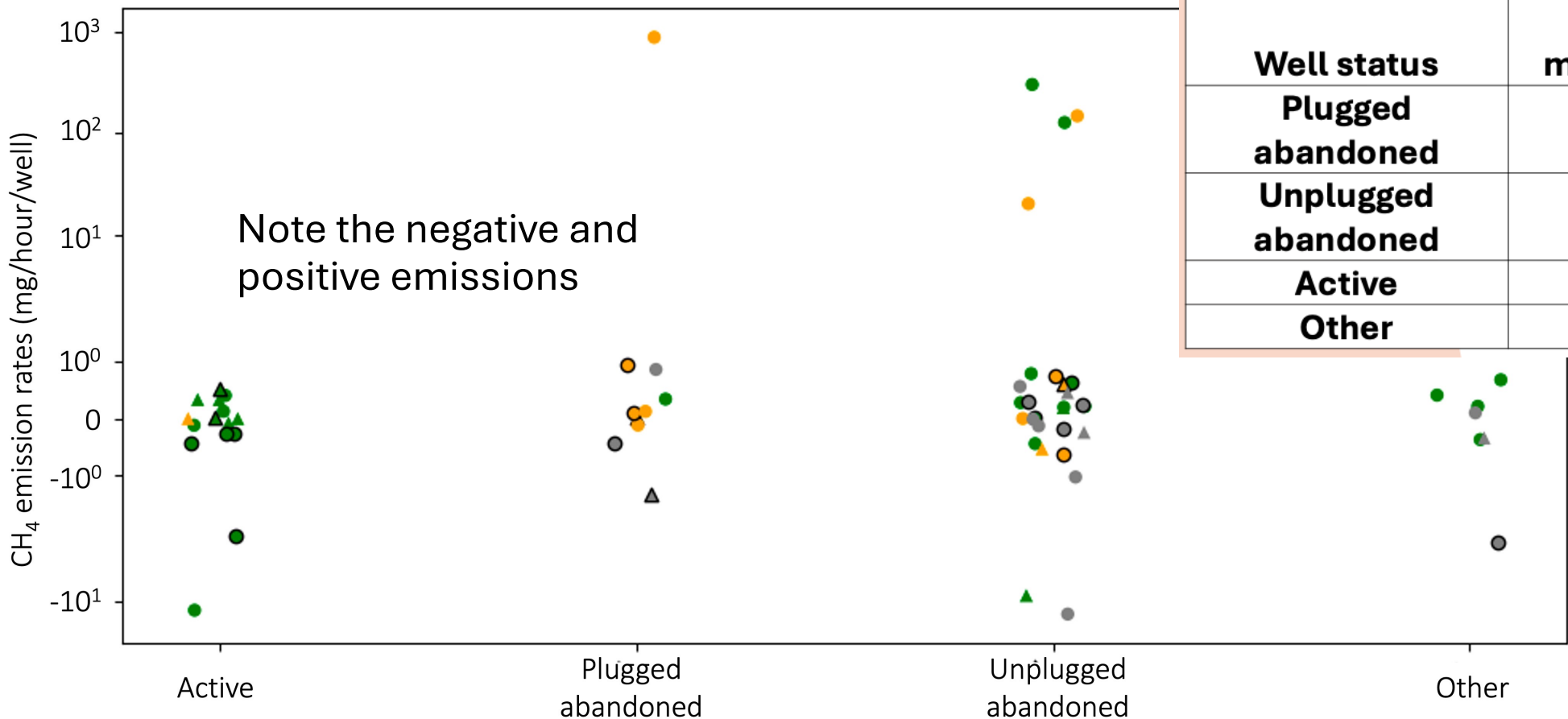


Soil emissions by measurement

Still only $\sim 0.1 \text{ m}^3/\text{d}$!



Soil emissions on the well-scale



Well status	Wells measured	% of wells with GM
Plugged abandoned	10	80
Unplugged abandoned	28	71.42
Active	15	53.33
Other	7	71.42

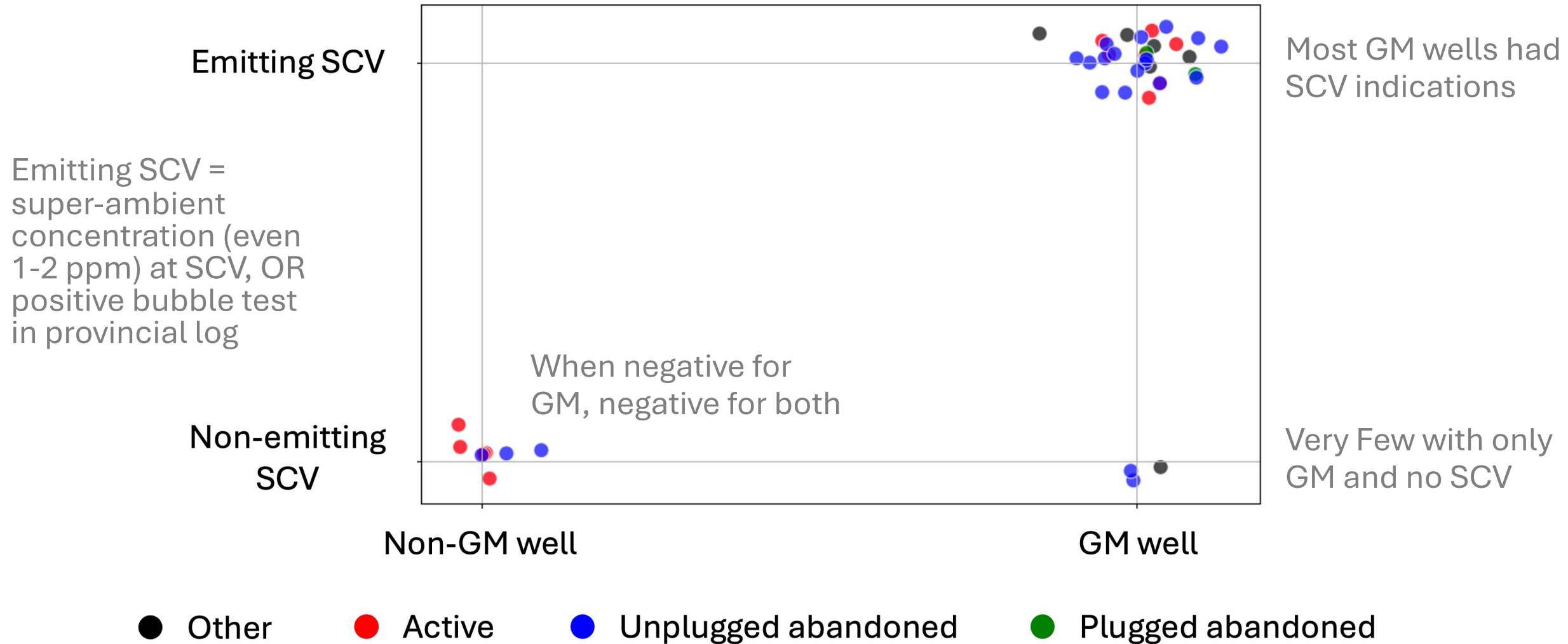
Fluid type	Symbol color
Oil	Orange
Gas	Green
Other	Grey

Sour status	Symbol contour
Sour	With black contour
Non-sour	No contour

Gas migration well	Symbol shape
True	○
False	△

GM = positive methane at any magnitude. Western soils don't normally emit methane...in summer soil microbes are a sink for methane

Relationship between SCV and GM emissions



What's happening here?

- We can quantify GM flow rates, to very low levels, with an inexpensive device that can be used summer and winter
- Winter measurements help give us a better read into the subsurface
- Seems that most wells are affected to some degree by GM
 - Most GM occurs at extremely small rates...no worrisome GM rates found at these sites
 - If that's the case, does a binary presence/absence provincial rule make sense? It may only if the measurement method is extremely coarse and insensitive.
- GM and SCVF are likely related flows that occur in tandem
 - If we measure closely enough
 - Study does not prove connectivity or feedbacks – shut in tests would be needed for that
 - Should they be regulated separately?