Agenda

1. Background
2. Introductions
3. Process Overview
4. Key updates
5. Open forum for feedback and suggestions
6. Next steps
BACKGROUND
Climate Action Reserve

• Private, nonprofit carbon offset registry, founded in 2001:
  – Develop carbon offset policies and protocols
  – Manage a registry of voluntary offset projects
  – Oversee independent verification program
  – Accredited Offset Project Registry for California Air Resources Board

• 18 different project protocols for U.S. and Mexico

• 122M offset credits issued, both voluntary and compliance (CA)
## Landfill protocol development history

<table>
<thead>
<tr>
<th>Version</th>
<th>Adoption Date</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>V1.0</td>
<td>Nov 29, 2007</td>
<td>Protocol adopted</td>
</tr>
<tr>
<td>V2.0</td>
<td>Nov 18, 2008</td>
<td>Improved accuracy and conservativeness in ER calculations and better guidance for MRV</td>
</tr>
<tr>
<td>V3.0</td>
<td>Dec 2, 2009</td>
<td>Eligibility for closed landfills with flares, updated definitions and QA/QC guidance</td>
</tr>
<tr>
<td>V4.0</td>
<td>June 29, 2011</td>
<td>Introduction of size threshold for LFG-to-energy projects in Performance Standard Test (PST)</td>
</tr>
</tbody>
</table>
INTRODUCTIONS
Reserve Staff

• Bety Zavariz, *Policy Associate*
  – Protocol development

• Sami Osman, *Senior Policy Manager*
  – Project management and protocol development support

• Heather Raven, *Senior Project Coordinator*
  – Project management and protocol development support
# Workgroup Members

<table>
<thead>
<tr>
<th>Name (alphabetical)</th>
<th>Organization</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jason Clarke</td>
<td>GHD</td>
</tr>
<tr>
<td>Nick Facciola</td>
<td>3Degrees Group, Inc</td>
</tr>
<tr>
<td>Jason Hoyle</td>
<td>Appalachian State University</td>
</tr>
<tr>
<td>Brian KillKelley</td>
<td>NativeEnergy</td>
</tr>
<tr>
<td>John McDougal</td>
<td>Element Markets</td>
</tr>
<tr>
<td>Rachel Oster</td>
<td>Diversion Strategies</td>
</tr>
<tr>
<td>Adam Penque</td>
<td>Centrica Business Solutions</td>
</tr>
<tr>
<td>Andrew Sheppard</td>
<td>US EPA</td>
</tr>
<tr>
<td>Patrick Sullivan</td>
<td>SCS Engineers</td>
</tr>
<tr>
<td>Barbara Tool O’Neil</td>
<td>Independent consultant</td>
</tr>
</tbody>
</table>

* Note that US EPA’s LMOP members are now observers
PROCESS OVERVIEW
## Protocol development timeline

<table>
<thead>
<tr>
<th>Milestone/Task</th>
<th>Timeline</th>
</tr>
</thead>
<tbody>
<tr>
<td>Public Scoping Meeting</td>
<td>Oct 2018</td>
</tr>
<tr>
<td>Convene Work Group &amp; staff commences update analysis</td>
<td>Oct 2018</td>
</tr>
<tr>
<td>1(^{st}) WG meeting (webinar)</td>
<td>Nov 15(^{th}) 2018</td>
</tr>
<tr>
<td>Staff begins drafting – working with WG</td>
<td>Nov 2018</td>
</tr>
<tr>
<td>2(^{nd}) WG meeting to review draft (webinar)</td>
<td>Jan 16(^{th}) 2019</td>
</tr>
<tr>
<td>Staff revises draft, incorporating WG feedback</td>
<td>Jan 2019</td>
</tr>
<tr>
<td>Public Comment period</td>
<td>1(^{st}) wk Feb 2019</td>
</tr>
<tr>
<td>Public Comment Meeting (webinar)</td>
<td>2(^{nd}) wk Feb 2019</td>
</tr>
<tr>
<td>Staff revises draft, incorporating public feedback</td>
<td>Feb – Mar 2019</td>
</tr>
<tr>
<td>Final protocol adoption by Reserve Board</td>
<td>Apr 2019</td>
</tr>
</tbody>
</table>
Workgroup expectations

• Attend and participate in WG meetings to the fullest extent possible

• Provide feedback on specific policy and technical questions
  – At WG meetings, one-on-one with staff, or in sub-committees

• Provide comments on draft protocols and protocol sections

• Be constructive, collaborative, and productive
KEY UPDATES
## Summary of Proposed Updates – major issues

<table>
<thead>
<tr>
<th>Protocol Element</th>
<th>Proposed change</th>
</tr>
</thead>
<tbody>
<tr>
<td>Project definition</td>
<td>Updated to allow for expansions into new cell to optionally be considered new project or part of existing project</td>
</tr>
<tr>
<td>Crediting period</td>
<td>Allow for 2\textsuperscript{nd} CP – with transition period for projects that have not maintained continuous reporting</td>
</tr>
<tr>
<td>Performance Standard Test</td>
<td>New end-use technology specific PST thresholds</td>
</tr>
<tr>
<td>Legal Requirement Test</td>
<td>Removed local NMOC threshold</td>
</tr>
<tr>
<td>Monitoring</td>
<td>New optional indirect monitoring alternative</td>
</tr>
<tr>
<td>Verification</td>
<td>Optional 24 month verification periods</td>
</tr>
</tbody>
</table>
## Summary of Proposed Updates – lessons from E&Cs / other protocols

<table>
<thead>
<tr>
<th>Protocol Element</th>
<th>Proposed change</th>
</tr>
</thead>
<tbody>
<tr>
<td>LRT</td>
<td>Updated NSPS / EG NMOC thresholds</td>
</tr>
<tr>
<td>Quant</td>
<td>OX factor guidance, hierarchy options for destruction efficiency values</td>
</tr>
<tr>
<td>Monitoring</td>
<td>Metering multiple devices with single meter, monitoring off-site destruction; monitoring for multiple projects at single facility</td>
</tr>
<tr>
<td>QA/QC</td>
<td><strong>Did not remove req for quarterly clean / inspect</strong>; temporary stationary meters; extra on-site field check; which instruments subject to portable meter requirements; <strong>Did not remove requirement to calibrate handheld device to known gas prior to each use</strong>; drift for Sage meters</td>
</tr>
<tr>
<td>Appendices</td>
<td>Updating default factors</td>
</tr>
</tbody>
</table>
Section 2.2

PROJECT DEFINITION
Project Definition: Expanding existing GCCS = new project

- OPTIONAL: expansion of existing GCCS into new cell(s) =
  - expansion of existing project OR
  - submitted as a new project – with new crediting period;
- Rationale: cost of expanding is high enough to warrant offset revenue for entire new CP
- Allow projects to share common destruction devices
  - provided monitoring is adequate
  - extra guidance for regulatory compliance – presumption any problems apply equally to all projects at site
Section 3.3

CREDITING PERIOD
2 Crediting Periods

- Allow for projects to apply for 2nd crediting periods (CP)
- Removing V4.0 PST size threshold – greater opportunities for existing projects to transition into V5.0 for 2nd CP
- **Mechanism to address any periods where did not maintain continuous reporting**
- Adopted *look-back period*, during which projects that expired under previous version can be submitted under this version for 2nd CP
  - provided project submit 1/more ZCRP(s) for any period in between when completed first CP and commenced 2nd CP;
  - **NOTE:** Also considering similar programmatic options for projects still within their first CP
  - Parties interested in 2nd CP should maintain monitoring and associated QA/QC until such time as they submit for a 2nd CP under v5.0
Section 3

LEGAL REQUIREMENT TEST
Legal Requirement Test

• Removed local NMOC threshold (Section 3.4.2.3)

• NMOC emissions threshold developed to address projects at landfills where treatment of LFG for NMOC was mandated but LFG destruction was not only treatment option

• Was 2 thresholds, if total mass flow of NMOC for LFG control system was greater than threshold, then project not eligible:
  – For sites which closed flares not required by law, threshold = 1,775 pounds NMOC/mth
  – For sites where closed flares were required by law, threshold = 2,575 pounds NMOC/mth

• WG feedback / research indicates flares are primary mechanism to address NMOC emission control mandates, therefore removing rationale underlying these thresholds

• Projects subject to closed flare mandate at local level are no longer eligible
Section 6

INDIRECT MONITORING ALTERNATIVE
• Section 6.1.1 Indirect Monitoring Alternative (Optional)

• Instead of using flow meters – can present method to use destruction device output data

• Output must be measured using commercial transfer meter (i.e. meter used to measure output for energy delivery contract)

• Conditions:
  – must propose appropriate conversion method (Break-specific fuel consumption calculations may be considered appropriate method)
  – must set out method clearly in monitoring report
  – must apply method consistently throughout the reporting period
  – must demonstrate to VB satisfaction:
    • that use of such data and method is reasonable in circumstances
    • results in conservative estimation of volume of CH4 destroyed
Section 7

VERIFICATION
Verification Periods

• Optional 24 month verification period
  – Get issued credits once verified
  – Can verify once every 24 months, or more frequently;
  – Can forgo site visit during given verification period if:
    • Site visit occurred during previous RP
    • Using same VB as for previous site visit RP
Section 3.4.1

PERFORMANCE STANDARD TEST (PST)
WG feedback

• NG is relevant but is not the whole picture
• Feedback was differentiated by types of LFG end uses
• Consider investment analysis
• Projects require incentives for feasibility
  – Renewable Portfolio Standard
  – Renewable Fuel Standard
  – Low Carbon Fuel Standard
• Due to economies of scale, larger landfills are likely not additional
New approach – three factors

1. LFG end use
   - High Btu – RNG and CG
   - Medium Btu – Direct use
   - Electricity

2. State of the market: Penetration rate and drivers

3. If needed - financial assessment
   - At what capacity can a project reach feasibility in the absence of incentives?
State of the market: penetration rates

- Common practice: Electricity projects
- Not-common practice: High Btu and Medium Btu

Total landfills: 2,525
Drivers per project type

High-Btu Projects
• Currently driven by RFS and LCFS
• Incentives provide approx. $58/tCO₂e
• 60% of projects planned for construction in LMOP are RNG

Medium Btu projects
• Linked to Natural Gas prices which are now at low levels
• Feasibility highly depends on distance to purchasing facility
• Gas treatment is a significant cost for feasibility
• There are insufficient incentives to drive these projects
Electricity projects

- Very complex market, historically mostly driven by RPS (RECs)
- Most of the states have met their RPS goals.
- High uncertainty in future of REC markets as states are reaching end of RPS goals.
- REC prices at 5 year low levels in some states

Source: Laurence Berkeley National Laboratory (July 2017).
<table>
<thead>
<tr>
<th>Consideration</th>
<th>High Btu Projects</th>
<th>Medium Btu Projects</th>
<th>Electricity projects</th>
</tr>
</thead>
<tbody>
<tr>
<td>Common practice?</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Clear market drivers?</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Given answers to questions above, is it BAU?</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>LFPP V5.0 eligible?</td>
<td>No</td>
<td>Yes</td>
<td>Requires further analysis</td>
</tr>
</tbody>
</table>
Financial assessment for electricity projects

- Question: At what electricity generation capacity do projects become feasible in the absence of incentives?
- Tool: LMOP’s Landfill Energy Cost Model
- 120 randomly selected projects
- When do they reach a positive NPV?
Model default values

<table>
<thead>
<tr>
<th>Relevant variables</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Loan lifetime</td>
<td>10 years</td>
</tr>
<tr>
<td>Interest rate</td>
<td>10%</td>
</tr>
<tr>
<td>Inflation rates</td>
<td>2 – 2.5%</td>
</tr>
<tr>
<td>Discount rate</td>
<td>8%</td>
</tr>
<tr>
<td>Down Payment</td>
<td>20%</td>
</tr>
<tr>
<td>Energy tax credits</td>
<td>0%</td>
</tr>
<tr>
<td>Electricity sales Price</td>
<td>0.06 $/kWh</td>
</tr>
<tr>
<td>REC revenue</td>
<td>0 $/kWh</td>
</tr>
<tr>
<td>Annual product price escalation rate</td>
<td>1%</td>
</tr>
</tbody>
</table>

• Other defaults:
  – Methane generation variables
  – Methane content in gas
  – Gas destruction efficiency
  – Operating Schedule
  – Etc. (complete list in protocol)
Project specific variables

- Year Landfill Opened
- Year landfill closure
- Area of LFG wellfield
- WIP
- Year WIP data
- Project type
- Marginal tax rate (21% private or 0% public)
- Collection and flaring installation cost included? No
- Initial year of operation: 2019
- Project size (MW)
- Flow rate: Manually adjusted
Results

- Private projects become feasible at 6 MW
- Public projects become feasible at 4 MW
## Final Performance Standard Thresholds

<table>
<thead>
<tr>
<th>Eligible LFGE projects under LPP V5.0</th>
<th>Not eligible LFGE projects under LPP V5.0</th>
</tr>
</thead>
<tbody>
<tr>
<td>▪ Privately owned projects up to an installed capacity of 6 MW</td>
<td></td>
</tr>
<tr>
<td>▪ Publicly owned electricity projects up to an installed capacity of 4 MW</td>
<td></td>
</tr>
<tr>
<td>▪ All Direct use projects (Medium Btu)</td>
<td>▪ Privately owned projects with an installed capacity above 6 MW</td>
</tr>
<tr>
<td></td>
<td>▪ Publicly owned electricity projects with an installed capacity above 4 MW</td>
</tr>
<tr>
<td></td>
<td>▪ RNG</td>
</tr>
<tr>
<td></td>
<td>▪ CNG</td>
</tr>
</tbody>
</table>
Next steps for the PST

• Incorporate WG feedback
• Refine assumptions
  – Financial assumptions
  – Incentive assumptions
• Threshold will likely shift
• Analysis possible without modeling specific landfills – makes process more efficient
Section 5

FEEDBACK AND SUGGESTIONS
Section 6

NEXT STEPS
Next Steps

• WG to submit comments/feedback by January 23rd
• Public Comment period being 2 weeks after that – wk Feb 4th
• Public Comment meeting – wk Feb 11th
Contact Information

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(213) 542-0298 (Pacific Time)

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(213) 542-0294 (Pacific Time)