N_20 Protocol Webinar Synopsis

Legend:

- ACR- Winrock and Applied Geosolutions developed; submitted to ACR
- NERP- Fertilizer Institutes developed; submitted to Alberta Offset System
- EPRI-MSU - EPRI-Michigan State U developed; submitted to the VCS
- 4R's – right source at the right rate, time, placement

	Protocol: ACR	**NERP**	**EPRI-MSU**
Protocol Element:			
Applicability/ Additionality	Can apply to a wide range of practice changes in Fertilizer Management: modifying fertilizer type, timing, placement, rate, use of timed-release fertilizers, nitrification inhibitors and other advanced fertilizer technologies. Similar to 4R concept although methodology does not use this terminology.	Applies to change in Fertilizer Management Practices; implementation of a protocol 4R Management Plan (right source, right rate, right time, right place)	Applies to change in Fertilizer Application Rates; best management practices must be followed in the project condition for the region; Additionality beyond the baseline is achieved by passing a Performance Standard Test irrespective of whether data for the baseline is derived from farmer records or from county level USDA data
Quantification Approach and Science basis (note – all follow IPCC guidance and include both direct and indirect sources of N20; all exclude soil carbon based on de minimis impact)	Tier 3; DNDC Process Model for direct N_2O emissions; IPCC factors for atmospheric deposition and volatilization and N leaching and runoff; default factors for emissions from fossil fuel combustion; default factors for emissions from fertilizer manufacture.	Tier 2; Based on empirical-based models, establishing regression analyses of N_20 emissions by N rate, and modified by key N_20 ecological drivers. Thus the emission factor is based on region-specific ecological drivers (soil moisture, texture, tillage, topography and irrigation) Based on ISO14064:2 process standard as per Alberta's regulatory requirements.	Tier 1 – based on IPCC defaults for within the contiguous United States and the states of Alaska and Hawaii**.** outside the North Central Region NCR); can include cropping systems within the NCR that are not corn row crop rotations. Tier 2 -Custom emission factors based on empirical models of fertilizer application gradients to N20 emissions for corn-soybean rotations (must be used in the NCR); Custom Emission Factors Tier 2 - A
N Input Sources (note - IPCC guidance considers N inputs from fertilizer N, manure N, crop residue N, residual soil N, irrigation N)	Includes IPCC sources of N inputs - fertilizer N and organic N additions such as manures – user must input; DNDC calculates crop residue N and biofixed N inputs, as well as mineralizable N.	Includes IPCC sources of N inputs – combination of user input and look-up tables for crop residue N; uses empirical equations similar to IPCC with Canadian region-specific custom emission factors.	Includes fertilizer and organic N additions only - user input or can use county level N rate recommendations to determine baseline. Does not include N from crop residue, residual soil N); Approach 1 – proponent records for synthetic and organic. Approach 2 – county level USDA yield data for N rate recommendations (applies to synthetic fertilizer only) - no equivalent organic data
Review Process	Developed by Winrock and Applied Geosolutions LLC; submitted to ACR for public comment, stakeholder consultation and independent external peer review. DNDC is a highly reviewed (140 peer-reviewed publications), parameterized model	25 US/Canada based scientists in development; Method and supporting empirical studies published in 7 peer-reviewed journals; Method reviewed by UNFCCC inventory review process; Alberta Offset System review process	Michigan State Scientists Millar and Robertson; method and supporting empirical studies published in 3 peer reviewed journals (1 published; 2 accepted); in early stages of VCS double validation process
Practice Coverage	Fertilizer rate, type, placement, timing	Based on a suite of 4R management	Based on proof of N rate reduction

	and timed release and nitrification inhibitor technology	practices at 3 performance levels; takes into account increasing sophistication of the 4 R framework	irrespective of whether producer practices N rate management to obtain agronomic or economic optimum, or the degree of technological sophistication adopted or maintained to reduce rate
Baseline Establishment	Project-level; based on management records of previous 5 years. Additionality must be established through regulatory surplus, common practice and barrier tests.	Project-level; based on management records of previous 3 years	The common practice threshold value is identical to the baseline calculation value for fertilizer N rate application irrespective of whether Approach 1 or 2 is used.
Data Input requirements	Relatively more intensive; many project level inputs specified; some look-up tables	Middle level of intensity; project input and documentation specified	Least level of data inputs
Assessment Scale	Project or multi-project	Spatial unit is biophysically relevant regions (Ecodistrict or possibly MLRA)	Empirical studies done in Michigan, extrapolated to NCR
Geographic Coverage	Potentially global depending on data availability to paramaterize DNDC for specific cropping systems (methodology has no applicability conditions limiting use geographically)	Right now, only Canadian conditions	Tier 1 defaults – areas outside the NCR (see above) Tier 2 emission factors – within the NCR for corn row cropping systems
Metrics –Functional Equivalence	Output based metrics (tonnes of N20-N or CO2e per kg of crop yield) – functional unit for baseline and project comparisons	Output based metrics (tonnes of N20-N or CO2e per kg of crop yield) - – functional unit for baseline and project comparisons	Based on kg N20-N per baseline vs project; Project level calculations for N2O emissions reductions in Mg CO2e annually
Uncertainty	Uncertainty estimated by DNDC modeling approach; 10% error threshold; Model structural uncertainty has been shown to be reduced by requirement to aggregate reductions to 10 or more fields (similar to NERP assumption regarding spatial scale of application versus individual fields).	Not explicitly addressed - implicitly accounted for in the conservative nature of the scientific review processes and ISO 14064:2 guidance; as well as balancing precision losses associated with using too broad a spatial coverage while avoiding the complexity of field level analysis where the spatial/temporal variability of N_2O dynamics and agricultural activity data can overwhelm	Like the NERP, reflects the uncertainty for an average of farms at the spatial scale applied, not for a specific individual farm; guidance provided on how to assess uncertainty.
Leakage	Applicability condition of methodology is no significant decrease in yields as a result of project implementation (total yield shall not differ between the baseline and with-project scenarios by more than 5% in any given year). No leakage deduction.	Possible controlled (on-site), related (upstream/downstream) and affected (market, activity shifting) sources are identified and where necessary, accounted for in the ISO 14064:2 quantification guidance	Conditions – land in production prior to project; no yield reductions, no yield compensation; no additional N use
Complexity	Most complex to implement; project developer will need modeling expertise for calibration and execution; many data points to verify; verifier competency will need to have familiarity with the model	Medium complexity; emission factor based but still considerable project documentation required; Implementation and verification assisted by sign-off of 4R Management Plans by trained Accredited Professional Advisors	Least complex to implement. Flexibility offered for lack of data; level of expertise needed by farmer/project developer and verifier is minimal.
Cost-Effectiveness	Likely achieved through aggregation	Geared toward aggregation at scale; streamlined application at regional level	Efforts and costs minimal.