1. TDEP Map Update (Gary Lear)
- Status of Map Project:
  - ➢ Maps are ready for distribution
  - ➢ Need to make a decision on wet deposition suitability before making publicly available
  - ➢ Comparison of MLM and TDEP deposition
- Wet Deposition Issues:
  - ➢ TDEP method is not consistent with the Program Office (PO)
    - – 2 km (PO) versus 4 km (TDEP) PRISM precipitation grids
    - – Computational precision (2 significant digits)
    - – AIRMoN data used by TDEP for precipitation but not included by PO
    - – MDN not included by TDEP but included by PO
    - – New PRISM algorithm as of June 2015; TDEP maps have not been reprocessed yet with new algorithm
  - ➢ Completeness Criteria
    - – Measured values from sites that meet NADP completeness criteria are used. If completeness criteria are not met at a site, then the value at that site will be derived from the IDW surface
  - ➢ Temporal Consistency for Long-term Trends
    - – Issue with sites going in and out of network. Model can compensate some, but not entirely.
  - ➢ Wet Deposition Options
    - – Live with the differences, or
    - – Adopt the Program Office version?
      - ▪ Would eliminate AIRMoN
      - ▪ Would not provide finer resolution
      - ▪ Precludes measurement/model fusion for wet deposition
    - – Proposal put forth by Gary to continue as before, i.e. live with the differences.
    - – Vote taken and all agreed to live with the differences
- Remaining Issues for Future Versions
  - ➢ Modeling Consistency:
    - – Moving to CMAQ version 5.1.1. This version has:
      1. Updates to CB05 (chemical mechanism) to improve N cycling and N deposition, including organic N;
      2. Secondary organic aerosols (SOA);
      3. Aerosol size distribution;
      4. Sea salt emissions;

5. Biogenic emissions;
6. Improved dust emissions;
7. Improved meteorology (WRF);
- Issues with Future Runs:
    1. There will be 1 year of base comparisons;
    2. Biases are unlikely to be similar;
    3. Probably unable to scale from one model version to the next;
    4. Don't know yet how to avoid discontinuity
- ➢ Ammonia
    - Not using AMoN; straight CMAQ values
    - Don't know how to fuse the bidi model surface with measurements
    - Currently working on spatial correlation study which looks at how AMoN sites change in space and time
    - Model is not getting ammonia correct:
        1. Emissions inventory (EI) is lacking in NH3.
        2. EI uses actual values from CAFOs and a new algorithm that allocates emissions.
        3. CMAQ uses EPIC model for fertilizer values
        4. There are significant biases in the south because measurement sites are on the coast
- ➢ 1in3 and Urban Networks
    - IMPROVE and CSN
    - National extent
    - Measure only PM2.5 which is <5% of total deposition
    - Different radius of influence for urban sites
    - Would be huge effort for <5% of total deposition
- ➢ Data Processing: The following items will change
    - Model extraction
    - Model processing
    - Aggregations, bias correction and variable/file management
    - Raster calculations
    - Mapping and graphics
    - Gary asked what the users want? Seems like people prefer Python over R
    - Donna asked who will do the data processing moving forward? TDEP is an NADP product. David Gay stated that the PO does not have modeling capabilities. EPA could still run CMAQ but the PO would need to add a modeler, PYTHON is the issue
    - There may be a PYHTON programmer that could be loaned out to PO for this purpose
- • Issues to be Tackled by Next Session

- ➢ Radius of Influence/interpolations: using measurements; using models
- ➢ Sea salt surface estimates
- ➢ Geographic Projection: changing from GRS80 to NAD83
- Transitioning from MLM to TDEP
  - ➢ TDEP:
    - − Spatially continuous
    - − Includes NH_3, NOM (NO, NO_2, PAN, PANx, etc)
    - − Only available from 2000-2014
    - − Unclear how future runs will be handled
  - ➢ MLM
    - − Discrete sites
    - − Model easily run for any time period
    - − Using historical average Vd at EPA sites
    - − Outdated methodology and unclear parameterization
  - ➢ There is good correlation between the two methods but not perfect. Bias caused mostly by Vd. Some sites compare better than others: ACA416 has good comparison, but ANA115 and BEL 116 are not so good. Comparison at JOT 403 also not good because particles have a big impact at this site. This is a good argument for including IMPROVE data.
  - ➢ Bret asked what causes the large underestimations in MLM:
    - − Model parameterizations
    - − Measurements in clearings
    - − All particles modeled as fine
    - − Ra parameterization
    - − It is also a known fact that this version of MLM greatly underestimates organic N
    - − Regions where these underestimations are really important are the east and west coasts, and main urban corridors.

2. Outreach (Kristi Morris)
- Meetings:
  - − We need to get to more meetings to get the word out about the TDEP maps
  - − Melissa Puchalski, Tim Sharac, and Chris Rogers will attend the National Ambient Monitoring Conference, St. Loius, MO, August 2016
  - − Bret Schichtel, Chris Rogers, David Gay (with booth) are going to the AWMA Visibility Conference, Jackson, WY, September 2016
  - − Gary Lear is attending AGU, San Francisco, CA, December, 2016.
  - − Donna will be attending CMAS, Chapel Hill, NC, October 2016.
  - − Nobody seems to be going to the ESA meeting in Florida in August

- Rick Artz – Europeans are using models, would be good to collaborate with groups like the WMO. Van Bowersox may be willing to present TDEP info.
- Webinars:
  - Another outreach option is to hold webinars.
  - CLAD has held many, but only people on the CLAD email list were notified. TDEP would like to reach people outside our current circle.
  - Donna and John want to have a conference call this summer. They would like to get Tilden Meyers and Rick Saylor involved.
  - Doug Burns suggested getting in touch with USGS/NACA as deposition is part of their modeling effort. They regularly organize webinars and they could help us facilitate a webinar.
- Products:
  - Another outreach effort would be to produce TDEP maps, similar to an NADP Summary.
  - Could include TDEP maps and NTN maps to show differences
  - Could also produce a joint product with CLAD
  - The 2015 NTN summary comes out this fall. TDEP could be on the same year as this?
  - David Gay noted that just printing the product would be easy. TDEP would need to get things together by July/August
  - TDEP and CLAD could produce two map products and could get exceedance maps ready by fall but would need to discuss whether to include all species or focus on just a few
  - TDEP committee needs to further discuss strategy

3. **TDEP Research Priorities (John Walker)**
- What are the ongoing research needs and emerging areas relevant to TDEP?
- The Priority Research Needs (PRN) were developed from revisiting the original Needs Table
- The PRN represents a combination of core needs: additional data sets of fluxes and concentrations, speciation budgets, assessment of methods, improvement of algorithms, etc.
- New areas include:
  - Source apportionment
  - Deposition episodes
  - Meteorological modeling in complex terrain
- The PRNs are:
  1. Measured Total N, S, and Hg Deposition Budgets
     - Process Level Studies
     - Routine Monitoring

- Methods Development
  2. Modeled Total N, S, and Hg Deposition Budgets
  3. Source Contributions to Total N and S Deposition
  4. Spatial and Temporal Patterns of Total N and S Deposition
- Looking for Topic Leads (TLs) who will be champions for one or more topics
  - TLs would responsible for conducting or following research related to a specific topic
  - Engage scientists outside the TDEP community
- Some topics have already been signed up for; looking to fill in names for the rest of the topics today
- Need a champion for Hg
- Goal is to develop a white paper by fall describing research priorities and ongoing Activities; TLs would contribute to their chapters
- Tamara Blett said lesson learned from CLAD were to prioritize, focus on a few key Areas, have PM or Lead setting up conference calls, monitor progress, accountability, etc.
- Rick Artz pointed out that Hg is an issue in pretty much every water body. Mark Cohen is doing a lot of work in the Hg arena and might want to touch base with him. TDEP needs to be relevant in other areas without being spread too thin.
- David Gay mentioned that AMNet was established to get the dry component of Hg and he will be presenting Lei Ming's results from AMNet. Also, Lei Ming is willing to be involved. David will approach him first with follow up by John.

4. Prioritization of Research Needs

The following items list the specific PRN's followed by the names of the TL's that were identified during the meeting

<u>1.0 Measured total N, S, and Hg deposition budgets</u>

- **Process Level Studies** (Topic area lead #1)
  - Direct measurements of speciated N, S, and Hg fluxes in select ecosystems (Greg Beachley and John Walker)
  - Measurements of surface chemistry/wetness relevant to fluxes (Bret Schichtel, with hopes of passing onto Jeff Collett)
  - Relationships between throughfall measurements and canopy-scale flux Measurements (Kristi Morris)
    Note: This effort could start out as a review since we do not have much canopy scale flux measurements. Would like to get Mark Fenn involved with this topic.
  - Urban deposition measurements (Emily Elliott and Pam Padgett as co-lead)
  - Deposition to snow and water surfaces (Beachley/Weatherbee)
    Note: This is a process level question rather than just analysis of snowpack; how do things get into the snowpack?

- Occult deposition (Selma)

- **Routine Monitoring** (Topic area lead #2)
    - Higher temporal resolution NH3 at subset of AMoN sites or other monitoring Sites (Melissa Puchalski)
    - Routine methods for organic N in precipitation (Melissa Puchalski)
    - Gas phase bulk alkyl and peroxy nitrates (Melissa Puchalski)
    - NTN completion criteria for high elevation sites (Melissa Puchalski)
    - **Notes:** Gary will come up with an inventory of NOx sites for next meeting; Bret would this topic listed under Routine Monitoring. Emily Fisher conducting some work on this and Eric Edgerton is measuring some of these species.
    Rick Artz mentioned that the emission inventories are not accurate and that we should not overlook satellite inventories. Rick will get Daniel Tong who works in this area to come to our meetings. John will follow up.
    Chris Rogers noted that we should a bullet under Routine Monitoring for oxidized N measurements; Emily has a student that can help with this topic.
    Greg Weatherbee volunteered for spatial variability of wet deposition, throughfall and urban deposition around Denver. New bullet (kind of…)
    Rick thought that 'fire emissions' can be a new bullet as Fire X is a new project that is coming up that will deal with wildfires, smoke, etc. Eric Williams is the contact person for this topic

- **Methods Development** (Topic area lead #3)
    - Open-path NH3 for direct flux measurements (Bret Schichtel in order to find someone)
    - Low cost time integrated deposition measurements (COTAG)
    Note: Micromet techniques. These could be deployed at a few sites. Only a couple of groups working with these methods. John will talk to someone at USGS about this. AL Hever at Purdue was suggested as a contact.
    - Comparison of micrometeorological flux measurement methods (Princeton group)
    - Assessment of NOx moly converter interferences – implications for oxidized N budgets and NOy flux measurements (John Walker)
    - Speciation of organic nitrogen in air and precipitation (Katie Benedict, tentatively)

2.0 Modeled total N, S, and Hg deposition budgets (Topic area lead #4)
- Development of bidirectional NH3 flux model for AMoN network (John Walker)
- Databases of soil and vegetation NH3 emission potentials for bidi modeling applications

- Development of in-canopy source/sink models that resolve deposition to ecosystem components (crown, understory, ground) and in-canopy chemistry (John Walker)
- Merging of soil biogeochemical and air-surface exchange models
- Improved representation of wet surface chemistry
- Deposition of dust and base cations (Donna Schwede)
- Occult deposition (Donna Schwede)
- Improved modeling of meteorology in complex terrain (Donna Schwede)
- Modeling of near surface chemistry and deposition over snow (Donna Schwede) **Notes:** Bret would like to incorporate IMPROVE mechanisms into CMAQ and CAMX. Also noted that we need a model evaluation component under this heading. Melissa added that CMAQ model versions also need to be compared and that we need to have a process for how we are going to evaluate future model versions/products

3.0 Source contributions to total N and S deposition (Topic area lead #5)
- Development and testing of source, receptor and hybrid oriented apportionment Methods (Greg Beachley)
- Contribution of regulated (NAAQS) and non-regulated sources to N deposition budgets
- Isotopic source apportionment of N deposition (NO2, HNO3, NH3) (Tammy Thompson/Emily Elliott)
  Notes: Rick commented that we need to be pushing for information outside of our group about Hg. Commission will be pushing for establishment of Hg sites in the Great Lakes area. Only a few would be AMNeT sites, most would be wet deposition sites. Mark Cohen is working on Hg and Rick will try to get him to come to our meetings. Eric Prestbo suggested that we can come up with line items for Hg, as for the other topics, and assign names. Gary noted that the Hg effort has to be coordinated by somebody from the Hg community. Kristi thought we should parse out some of these topics and see what can go to graduate students.

4.0 Spatial and temporal patterns of total N and S deposition (Topic area lead #6)
- Importance of deposition episodes (biomass burning, upslope meteorology) to annual budgets (Greg Beachley)
- Relationship between long term trends in emission and deposition (Chris Rogers/ Selma Isil)
- Spatial variability of ammonia in agricultural regions (Kristi Morris)
- Contributions of organic and inorganic oxidized and reduced N compounds (Bret Schichtel/Donna Schwede/Jeff Collett)

5. TDEP Renewal
- Kristi will be giving a presentation to the NADP Executive Committee asking for renewal of the TDEP Science Committee. The presentation will cover:

- ➢ The mission of the TDEP Committee
- ➢ TDEP Charges
- ➢ TDEP accomplishments from 2011-2015
- ➢ Work motivated by the TDEP mission; and
- ➢ Future TDEP Efforts
- ➢ Presentation of the PRNs

6. Hg Dry Deposition Velocity Calculations
- Leiming Zhang will continue to produce weekly dry deposition estimates from all AMNet sites for all years that AMNeT has run
- David Gay proposed to put Leiming's estimates on the web
- It was commented that there is a need to clarify how met data was obtained from the archived surface-layer model
- Coarse PBM is included in the deposition budget; how much Hg is in this fraction? Eric Edgerton has been measuring this fraction, but if Leiming got his values from the literature and has not been using Edgerton's results because they are not published, then the differences can be significant depending on location
- Leiming has used:
  - ➢ 24 sites, 3 of them collocated
  - ➢ Land cover fractions within 3 km radius for each site
  - ➢ Interpolated daily leaf index for dominant land cover
  - ➢ AMNet concentrations
- Some results are:
  - ➢ GEM about equal to wet deposition Hg at Mississippi site
  - ➢ Dry deposition big player for Hg
  - ➢ We are not measuring the correct fraction in wet deposition
- Doug commented that these results should be presented with uncertainty values
- Gary would be in favor of putting these values out after further review with the clarification that this is just one approach
- GEM bidirectionality is recognized. We need elemental Hg in the hg budget based on Marty's litterfall data
- Recommended that it would be helpful to compare these results with some the CTM results
- Also recommended that Marty's results should be published first and then Leiming's article to follow
- Eric Prestbo would like to wait on putting these results on the web. He would first like a scientific discussion of the results by maybe same people as were on the Review Committee? Mark Cohen, Mae Gustin, and Charlie Driscoll suggested as being on this committee. Eric will organize another ad hoc committee to evaluate results.

7. Election of Officers
- Chris Rogers was nominated to take over Gary Lear's position as Co-chair
- Kristi would like to institute process of Chair and Vice-chair that rotate on a 2-year term
- Kristi will be Chair for this year and Chris will be Vice-chair; Chris will become Chair next year and a new Vice-chair will be nominated
- Gary will continue to do the data processing, but will need to come up with a future plan as to who will take over these duties

8. Meeting Adjourned