From Particles to Populations
A retreat to kick off the University of Utah Program for Air Quality, Health and Society
Fort Douglas, March 4, 2013

Notes and Recommendations

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SECTION 1. OVERARCHING THEMES FROM THE RETREAT

1.1 Facilitating collaboration
A recurring theme was the need to identify and foster interactions among researchers from different disciplines and even to serve as a matchmaker for researchers. Suggestions included:

- Facilitate regular interaction and communication with seminars, research-in-progress meetings, a meeting with a series of 5-min research summaries, monthly working groups, etc.
- Form working groups that each focus on a research theme with a goal of securing funding.
- Use the website (or start a Facebook group), post bios/research interests of researchers (or develop a searchable database) and start a discussion board.
- Clear and accessible information identifying roles, resources and work already performed across campus.
- Start a mentorship program.

1.2 Need for the Program and unbiased data
The participants emphasized the need for such a program, the need for coordination to facilitate collaboration, and the need for high-quality unbiased air-quality related data, including the need to learn about existing data within other research groups.

1.3 Focus
There was agreement around building upon our strengths. However suggestions for the Program’s focus ranged widely. A number of participants also expressed concern over lack of focus and on directing efforts towards solutions. This is a highly competitive research area and in order to be successful, these participants felt we need focus. Other participants felt strongly that the Program needs to focus more broadly and on solutions. Section 3.1 contains additional detail.

1.4 Program structure
The program should have a clear structure, a face, and multidisciplinary external and internal steering committees. These committees should have clear roles, and we need to ensure that the work remains objective and unbiased.
1.5 Retreat highlights
- Excellent turnout and enthusiasm.
- The diversity of relevant expertise throughout the university.
- 87% of the participants found the retreat useful or very useful.
- Arden Pope’s talk. One commenter: “Prof. Pope is a state treasure”.

1.6 Recommendations for future meetings
- Provide more unstructured time for people to interact, particularly during lunch.
- Draw a better link between measurements and health effects.
- Place more emphasis on goals and the path forward.
- Form working groups and have reports from these groups.
- Provide highlights of research collaborations that result from the Program.
- Allow more time for discussion after the panels or speakers.
- Consider bringing in outside speakers.
2.1 What are key missing data impeding future studies?
This question yielded the greatest variety of responses. We’ve highlighted recurring recommendations below with additional recommendations in Section 3.2.

- Individual-level exposure data.
- Mechanistic understanding of the effects of specific pollutants or compounds.
- Insufficient health outcome data. We have death and admissions but lack other important impacts, i.e., prenatal, outpatient visits, medication.
- Better characterization of pollutants including particle size and composition.
- Better understanding of atmospheric chemistry.
- Better inventory.
- Better understanding of the geospatial distribution of pollution concentration and coupling this with health data.
- How do we encourage needed behavioral changes?
- How do we communicate existing and new research results to the public?

2.2 How do we maintain current enthusiasm for air quality studies?
The most common recommendations were pursuing and securing funding and fostering collaboration (see Facilitating Collaboration, Section 1.1).

2.3 Suggestions for the seed grant program?
Four common themes emerged from this group regarding funding criteria:

- The grants should be interdisciplinary, involving researchers from more than one department. Some suggested that the grants should also involve new collaborations.
- The grants should include a plan for applying to extramural funding.
- The program should provide quick turn around of the funding applications.
- Focus seed grants on areas where Utah has strength and a good chance at securing extramural funding.

2.4 What is your best ‘out of the box’ idea?
Several groups suggested crowd-sourced pollution or traffic measurements, which would also foster public discussion, and using the University of Utah as a test bed for studies and potential solutions. See Section 3.5 for additional detail.

2.5 Other important comments
A number of groups had recommendations regarding potential funding sources (i.e., NIH, NIEHS, EPA center, UDOT, sustainability seed grants) and strategies. For example, to secure industry funding we need to make a robust business case and the other pieces can fall into place. We can’t affect change through the legislature without a strong business case, and we
can’t develop a control strategy without good information.

2.6 What are key strategies to promote collaboration across university units?
*P. McNeally, Geography and M. Supiano, Geriatrics (Leads) with R. Coil (notes)*
The highlights from this program are mostly covered under Facilitating Collaboration (see Section 1.1). They also discussed sponsoring intercollegiate synergy grants, student training and involvement, co-teaching, obtaining credit for this work on FARs and MDMs, and considering differential tuition across campus.

2.7 What are key strategies to draw investigators to study air quality?
*C. Reilly, Pharmacology and K. Henry, Geography with M. Maestas (notes)*
Some of the discussion of this group is summarized under Facilitating Collaboration (Section 11), Program Structure (Section 1.4) and SEED Grant Funding (Section 3.4). Other recommendations include providing financial and departmental support to people making a transition to this area.

2.8 How should we engage groups external to the University?
*R. Kanner, Pulmonary Medicine and A. Walker, USTAR (Leads) with J. Ruple (notes)*
Discussion focused on engagement with DAQ, industry, and other government organizations.

- DAQ needs a better understanding of chemistry, meteorology, and messaging.
- DAQ does not have funds to contribute, but they have data and would support legislative efforts.
- For industry, the program needs to make a business case for funding requests.
- Other organizations to consider engaging: UDOT, Chamber of Commerce, tourism interests, NOAA, other universities (USU, BYU, University of Wyoming), UCAIR, Department of Health.

Additional detail on these discussions can be found in the Section 3.7.

2.9 How can we promote and take advantage of engagement with the community?
*M. Straube (Law) with A. Gilliland (notes)*
The group recommended the need for constructive civic dialogue using understandable language about air pollution, including the need to:

- Target communities/groups individually but stress that this is everyone’s problem.
- Figure out how to communicate about environment, including highlighting available data (e.g., “nerd-mobile”).
- Perform research associated with community engagement.
- Sponsor a dialogue around potential solutions to the air quality problems in Utah/Wasatch Front.

One of the other groups noted that the college of engineering’s air pollution course has a community engagement component, but getting students to work on projects is the hardest
part because students lack time and skill.

2.10 What short and long-term goals should be identified?

S. Collingwood
It is important to recognize the challenges facing us in this competitive area. We need to build from a strong foundation. A key approach is to target smaller grants before going for larger ones. They also discussed:

- **Short-term goals:**
  - More fully assess our local advantages both in terms of investigative strengths and local environmental characteristics.
  - With the technologies and synergies at the UofU develop predictive model of health outcomes.
  - Validate the new crop of personal monitoring technologies.
  - Promote development of groups of interactive investigators with:
    - seminar series or research in progress.
    - seed grants to both draw in new investigators and stimulate formation of collaborative groups.
  - Offer grant review from senior investigators
  - Develop mentoring relationships for junior investigators interested in the area.

- **Long-term:**
  - Federal funding (both individual grants and multi-PI grants).
  - Ultimate goal of NIEHS or EPA center award.

2.11 What roles and goals should this program have for education and training?

J. Facelli, Biomedical Informatics and B. Bowen, GCSC (Leads) with N. Lereau (notes)
This group emphasized the need for cross training of each other, i.e., to bridge policy, economics, and science. Engineers and scientists should understand the health effects and vice versa. They also highlighted the need to invest in students and the development of good outreach, education and training programs, which can help get grants.

2.12 What are our greatest strengths and liabilities or impediments?

J. Ehleringer, Biology and A. Weyrich (Leads) with B. Jones (notes)
This group recommended that building on our strengths we focus on being the first to develop spatial relationships between health effects and air pollution. Our strengths include:

- The Utah Population Database, computational capabilities, health informatics, industry cooperation, pediatrics, and epidemiology.
- Utah’s unique air quality problem, the scale of our problem being tractable, and our population, which is volunteer and research oriented.

Our weaknesses include:

- Being years behind the competition.
• Having silos on campus and not talking to each other.
• Having a poor understanding of the atmospheric chemistry.

2.13 How should we seek to link health and economic data?
C. Sweeney (Lead) with I. Hunsacker (notes)
This group discussed the healthcare and other costs associated with poor air quality, potential data sources and gaps. Potential costs include healthcare costs, costs of complying with regulations, and cost of absences from school/work. Data sources include: charge per patient and medicare databases, birth and death certificates, BRFSS (CDC’s behavioral risk factor system), and student absences. Gaps and opportunities include: reproductive outcomes, lost workdays, less severe medical outcomes (physician visits, medicine), companies/employees that won’t relocate to Utah because of air quality, and the lack of exposure data. Section 3.8 contains additional detail of this discussion.

2.14 What can we learn concerning approaches to influencing individual behavior for a broader societal good?
M. Hoffman, Pediatrics (Lead) with M. Hahnenberger (notes)
Discussions by this group and a few others suggested that there is a lack of public understanding of the impact of their actions as well as a lack of understanding of currently available data. They discussed the role of incentives (carrots) versus rules/policy (sticks) and recommended that we need sticks, i.e., anti-idling laws. They also discussed learned helplessness, i.e., changing behavior is too insignificant to matter. Their recommendations included:
• Identifying exactly what changes we want people to make so that we may give them choices.
• Quantifying the effectiveness of our approaches to changing behavior.
• Including researchers in behavioral psychology.
• Using understandable language when trying to communicate to the public.
Section 3.9 contains additional detail of this discussion.
SECTION 3. COMPREHENSIVE NOTES FROM THE BREAKOUT DISCUSSIONS

We have attempted to include material that is not covered under the highlights section.

3.1 Focus
Suggestions for the Program’s focus ranged widely. A number of participants also expressed concern over lack of focus and how to become competitive in this research area in light of very diverse interests.

Suggestions for more focus
- We might be bighting off too much for a statewide effort – the Program should focus on the Wasatch Front & Cache Valley. Alternatively, start focusing on the Salt Lake Valley, followed by the Cache Valley and the Uintah basin.
- The participants are highly diverse. If the goal is to develop a competitive Program Project grant we should develop an academic research program around this important topic. “Solving the problem” is way out of reach and perhaps not even within our academic mission.
- This is a very competitive research area. We need to find a niche in which we can be competitive. This will require to select a specific area, which is broader than an R01, but much more narrow than the interests represented at the retreat. To be effective in securing preliminary data for a Program Plan grant submission the seed grants should be concentrated on a target area.
- We should consider moving our efforts towards a mechanistic driven Program Project. A possible approach for such Program Project would be:
  - Select a specific disease influenced by inhalation of small particular matter
  - Develop mechanistic hypothesis for this specific disease.
  - Develop a lab and environmental measurement strategy to gather (either by reuse or new acquisition) relevant data for this problem.
  - Develop mathematical/computational models that can fit the data
  - Identify (if any) specific components of the small particles that are causal to the medical condition.
  - Using the modeling capabilities track back these components (or its precursors) to sources
- Focus on local air-pollution issues and leave greenhouse gas emissions to a national effort.

Suggestions for broader focus
- Focus on a multi-disciplinary approach centered around solutions and vision.
- Capitalize on natural experiments – new TRAX line, Olympics led to more use of public transit.
- Include social, behavioral, and policy researchers.
• Consider radon.
• Consider air pollution and mental health.
• Involve more individuals from: urban ecology, social and behavioral science, policy, and advocacy organizations.
• More focus on actions.
• Consider alternative energy.
• Global warming is an important consideration.

3.2 What are key missing data impeding future studies?

Health outcomes

• Insufficient health outcome data. Mortality and hospital emissions are endpoints that have been considered a lot, but short of dying and short of being admitted at a hospital, what other impacts have been occurring. Are they seeing their outpatient doctors more frequently, are they taking more medications? Let’s look at the lower consequence health effects such as symptom days or kids missing school. The availability of the various data that would capture health effects of smaller consequence events.
• Need emergency department visits.
• Health protector data – why are some individuals more susceptible?
• Need granular electronic health data
• Quantification of recruiting losses or departures from state (there is actually a Facebook group for people that have left Utah due to poor air quality). I was unable to find this Facebook group.
• There is not a really good comprehensive health database with the data. Not true, but people don’t know where to go.
• Need to follow people over their history.
• Consider focusing on biomarkers of exposure.
• Easiest to perform epidemiology studies with children.

Measurements and models

• Get parcel-level data use satellite data OCO-2. Note one group expressed concern over relying on CO and CO₂ data as indicators of other pollutants because they do not always correlate well, and different sources have different ratios of PM₂.₅/CO₂, for example.
• Improved data/models.
• Tie Lagrangian dispersion models to health outcomes, i.e., autism.

Costs

• Costs of regulation on business (e.g. small business impacts).
• Cost of low-income people who don’t go to the ER when they are sick.
• Costs of non-hospital medical impacts (primary doctor visits, medication)
• Lost income due to unsuccessful recruiting of people and businesses, and departures.
Community engagement and behavioral change
- Which groups of people do we need to talk to and how? We need to direct information to the right targets, not to people who already know.
- Confirm what the community already knows about air quality and what they don’t know (facts and perceptions).

Other
- Translate what is already known into policy.
- What are the key future questions? This drives the data you need.
- Credibility gaps.
- May not need additional research, may already have this knowledge within the U and just need to share it.
- Consider radon.
- Add GIS layers to exposure history, etc.
- Additional research/analysis on policy options to improve air quality, especially along the Wasatch Front

3.3 How can we sustain the current enthusiasm for studies of air quality?

Funding
- Sponsor fellowships or grants for graduate students.
- When grants come in, they encourage collaboration with other groups. The hope is that by getting grant money, a group can continue to get more money.
- If funding starts with researchers from the U, make it possible for community members and leaders to eventually become involved and take over.
- If funding starts through a SEED grant, hopefully others will become interested and involved.

Other
- Focus on improved measurements and health effects. Whatever the study is, you need to deliver data on one of these two fronts in 1 year.
- Retreats are good to get the enthusiasm high, but it seems to dissipate after that.
- Do not become a “cause of the month” – do not let people get fatigued or forgetful.

3.4 Suggestions for the seed grant program?

Focus
- Focus on one of two themes:
  b. Health affects.
- Novel concepts.
- Include great, diverse ideas that we can all do.
- Include social and political sciences.
• Sponsor pilot projects or train-the-trainer workshops that can be handed over to the community for implementation:
  o Community awareness-raising approaches.
  o Actual solutions to improve air quality.
  o Policy development.

Criteria
• Serve as a platform for a bigger grant.
• Have a 1-year deliverable product.
• Partnerships of more senior and junior researchers (mentorship).
• Fund postdocs. Difficult to put small-scale results into a bigger grant.
• Include impact and evaluation.

Process
• Use an RFA style seed-grant program where investigators submit paragraphs on what we want to do, then organizers request an RFA.

Other
• Could part of the grant be to offer a grant for schools or interested parties who want to study AQ in their own way?
• It should include communication of project results to multiple audiences in understandable language.
• The funded grants should contribute in some way to community involvement and dialogue on air quality issues.

3.5 What is your best ‘out of the box’ idea?

Gathering health data
• Heel stick blood test data for newborn children.
• Human hair sampling.

Other
• Using the large message boards on the interstate to show current and forecasted air quality/info about emissions?
• High efficiency filters.
• Have a little bit of fun. For example, challenge the UofU to reduce pollution during inversion or ozone season. Weber State tracks their pollution.

3.6 Challenges and solutions
Although this was not a question, we received some response on this topic.

Challenge
• Voluntary actions don’t count for the SIP.

Solutions
• Do not only take action on the worst days, do it regularly.
• Work on better enforcement of the no idling ordinance.
• Need a public health emergency mode for air quality.
• In addition to research, the U should lead the way, undertaking actual activities.
• Evaluate the effectiveness via whether there is follow-through on solutions.
• We need to become accustomed to using transit. In Boulder 60% of university employees must use transit.
• We have a culture of driving – no carpooling. The next generation will not change without dis-incentivizing this behavior. MAD – mothers against driving.
• Stanford found that by shifting 8% of their commuters, they could alleviate congestion.
• Transit passes for UofU employee families.

3.7 Individual Question 3. How should we engage groups external to the University?

DAQ needs
• Messaging – what information does DAQ want to get out?
  o Already hit large point sources.
  o Population growing rapidly.
  o Vehicle miles traveled growing faster than population.
  o Need for behavioral change.
• Meteorology and climate poorly understood
  o How big is the box and how high is the lid?
  o Models good for weather are not very accurate for AQ modeling.
• Chemistry - Good basin understanding but uncertainty remains.

Industry needs
• Better the inventory data leads to a better the regulatory strategy.
• Diversity of emissions and impact – hard to lump industry.

Other government organizations not included in the summary: the interactions with EPA will depend upon the location. For example, EPA has a greater role in the Uintah Basin because of Indian Country issues.

Funding:
• Is it enough to say that we are going to make air quality better – would that appeal to industry?
• Message must be tailored to the target funder

What do we mean by “engage”?
• Increase awareness?
• Increase funding?
• ID stakeholders?
• ID data sources?

Messaging
• What do we need to do drive public behavioral change?
• How do we engage people?
• What is the public’s role?

3.8 Individual Question 9. How should we seek to link health and economic data?

**Potential sources of data**

- Charge per patient service database (1996-present) including provider and facility breakdown.
- Demographics, including social disparity of risks.
- Birth certificates. We have all the birth certificate info for the state. Some of these data are related to air pollution, such as low birth weights, decreased development, this is something where data already exists but isn’t being used.
- All payer claims database. This is on the horizon. Since ’07, by legislative mandate, APCD data.
- Medicare claims.
- Demographic data vs. disparity of risk
  - Linking geographic patterns of risk and socio-economic data.
- BRFSS -> closes a data gap, but data already exists.
- Student absences. Maybe parents are keeping kids home because the air quality has been advertised as poor, and not just because the kids are sick. But either way, their education is suffering if they don't show up to school.

**Other:**

- Economic data for people with low income may be the ones living next to the refinery or close to the freeway. Demographics are linked to social disparity.
- Could we consider hourly hospital admissions data? The hourly PM$_{2.5}$ and daily PM$_{2.5}$ levels are being tracked. People don't go to the hospital the moment the pollution spikes, but the day of or the day after, or even the week after.
- Is there a way to look at the impact on recruiting? One way to look at that is to look at people who were here but chose to move because of the poor air quality. We can see the history of respiratory related illnesses, and because the Utah Population Database partners with the DMV, if these people ever move, we have that data. So we can correlate people with a history of respiratory disease with the likelihood of them moving out of state. When they leave Utah, they report where that person moved to. Then we can look at some of the top-notch people we lost, and we can infer that they moved because they had respiratory illness.
- Is there a way to measure admissions enrollment to try to correlate admissions to those who are choosing to go to a university because of air quality. There are those who have asked where in the city it is better to live to get the better air quality.
- A good study would be to see if people are considering living in certain places because of air quality. There is a CDC administered BRFSS survey that asks these questions,
and researchers can solicit the CDC survey to add questions to that survey. As long as the questions are approved, it is easy to get them on the survey. It is a high quality, statistically significant survey.

3.9 Individual Question 10. What can we learn concerning approaches to influencing individual behavior for a broader societal good?

The discussions included:

- Incentivizing vs. cost.
- Cost-benefit analysis.
- To change behavior, you must be able to enforce a policy. For example, no smoking in a vehicle is unenforceable.
- Systems design. We must design for the future. These choices will affect how the rest of the system develops. Including transit, roads, and housing. For example, childcare on campus.
- Educate people about air pollution through social and mass media.
- Find ways to reward people instead of making them feel guilty.
- Stress that everyone affects everyone else.

If we want to encourage behavior change, we need to:

- Quantify the effectiveness of dialogue and community meetings. For evaluations of public involvement – ask:
  o How did you change your behavior and why?
- How did community members “feel” about the effort?
  o What changes did community members made (if any) as a result of the effort?