



# Appalachian Storage Hub (ASH) Project

## Team Meeting Minutes

June 7, 2017 – 10:00 – 11:00 am

1 (877) 306-9784, Code 211 437 2313

**Present:** Doug Patchen, Toni Markowski, Kris Carter, Mohammad Fakhari, Michael Solis, Mike Angle, Jessica Moore, Gary Daft, John Bocan, John Saucer, Phil Dinterman, Mary Behling, Mike Hohn, Brian Dunst, Robin Anthony, Katie Schmid, Eric Hirschfeld (PA intern), Ellen Davis (PA intern)

### 1) Reservoir Characterization Progress

The research team has focused its reservoir characterization work on four types of “storage containers”: mined-rock caverns (i.e., Greenbrier), salt caverns (i.e., Salina F4 Salt), depleted gas fields, and natural gas storage fields.

Greenbrier facies mapping/assessment (Jessica, WVGES) – WVGES has successfully mapped two Greenbrier facies (lime mudstone and grainstone) for parts of WV in the depth range of 1800-2000 ft using certain geophysical logs (bulk density, PE and caliper). Although log coverage is better in the southern portion of study area, PAGS (Katie Schmid) has performed similar work in northern WV and PA using (primarily) PE logs and/or GEO (lithologic) logs to come up with picks for ~70 wells in the AOI. **WV and PA will meet on merging this work in the next day or so.**

Salina F4 Salt/salt caverns (Michael, OGS) – **OGS is preparing a more detailed write-up with maps for each of the four F4 Salt areas presented in the 3<sup>rd</sup> quarterly report, and will include information on well penetrations, what’s currently happening at Mountaineer, etc. WVGES has many binders of UIC info to share regarding solution mining wells in these areas and is currently uploading them to the ftp site.**

Depleted gas fields/natural gas storage fields (Kris, PAGS) – PAGS has asked for each state to review the field-level reservoir data compiled for the SHORTLIST of prospective fields provided to the group yesterday. We want to be sure each state is satisfied with the content and coverage of reservoir data provided for fields that PAGS will be ranking using the final criteria (see below). These data will be used to support the field-level mapping that PAGS is preparing for the (soon to be determined) most prospective fields. **Please respond to Kris with comments/revisions by next Wednesday, June 14.**

PAGS commented that the final MapPaks provided by OGS for the 3<sup>rd</sup> quarterly report were modified a bit with respect to content (Salina F4 Salt in PA and Newburg Ss in WV), as well as for color-ramp consistency. These have been placed in the 3<sup>rd</sup> quarter reporting folder on the ftp site for **OGS to consult/incorporate into the final geodatabase/shapefile preparation work that they are doing now.**

Thin section analysis is ongoing in Pennsylvania. Pittsburgh staff are analyzing thin sections of the Oriskany Ss, and Middletown staff are analyzing the Rose Run-Gatesburg, Newburg, Venango and Keener-Berea thin sections.

Development of Field-Level Prospect Areas (PAGS) – PA will be reporting its reservoir characterization data and mapping results by grouping data into prospect areas (as many as three for the AOI). To this end, all reservoir characterization work is being done at the FIELD level, which means that PA is requesting all states to provide relevant well data for those fields listed in our SHORTLIST spreadsheet, as well as for any/all neighboring areas that would be helpful for our partners moving forward. It is necessary that any well point data you share with the research team include the FIELD NAME with which it is associated. PAGS is asking for these well data, relevant log curves and/or available raster logs for these fields by provided to PA no later than Monday, June 19. (It is envisioned that your SHORTLIST reservoir data review work will lead you to this type of information anyway, so hopefully, this request for as-available data is not a huge ask).

The group agreed that keeping the presentation of storage opportunities at the field level, as part of a few grouped areas in the AOI, is preferred over recommendations using geopolitical or site-specific boundaries.

Strategies/Activities	Start Date	End Date
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**2) Application of Ranking Criteria (Kris, PAGS)**

The research team will be applying different ranking criteria depending upon the type of storage container: mined-rock caverns, salt caverns or depleted gas fields/natural gas storage fields. As stated in the 3<sup>rd</sup> quarterly report, a set of preliminary criteria was used to identify the shortlist of gas fields/gas storage fields that will be included in PA’s reservoir characterization work. For the mined-rock and salt cavern opportunities, mapping was used to delineate the shortlist of areas in the AOI where these resources may be prospective.

PAGS will apply the “Ranking\_Criteria\_5-1-2017\_KMC” (see the ftp site) to the SHORTLIST of prospective fields as part of a final ranking effort. For this effort, the Greenbrier and Salina opportunities will be ranked as well, albeit by a different number and type of criteria due to the nature of these proposed containers.

**3) Suggestions for Follow-Up Engineering Study (Doug)**

Doug led a discussion of how much attention the research team should give to engineering-related matters that are beyond the scope of the current study (see bullet list below). Specifically, how much of this information do we acknowledge/address/include (or not)? And what are the ramifications of not mentioning these caviats? After some group discussion, it was agreed that we should include a chapter on this topic in our final report, and that we include everything in our direct and peripheral vision, so that project stakeholders can take our geologic findings and ask the right questions of any engineering and site-specific work that is performed as a follow-on to our study.

- Greenbrier Limestone – Ethane must be pumped.
- Storage fields – Will ethane be compatible with residual dry gas?
- Depleted gas fields – Will there be mixing of ethane, methane, water and/or other liquids? How to withdraw? Should a gas cap be added to increase energy/manage pressure?
- Salina F4 Salt – How to dispose of produced water when creating the cavern? How expensive might this be? What kind of pumping will be needed to withdraw product? The integrity of the cavern roof over time is a definite concern (production wells may be damaged by collapse). A teardrop/cone shape is better than a rectangular shape.
- Fate of ethane – Will it remain liquid or mix with gas?

**4) Final Report Preparation (Doug)**

Doug indicated that he and Kris are developing a draft annotated outline for the final study report now. Kris added that the format and organization of the report will be very similar to the 2015 Utica Shale Research Consortium report. As soon as it’s ready, the outline will be posted to the project ftp site for everyone to use.

Strategy 1: Data Collection		
• Identify and assemble well log and core data	Month 1	Month 2
• Identify previous studies of interest	Month 1	Month 2
• Create a project database (format, prototype)	Month 1	Month 2
Strategy 2: Stratigraphic correlation of key units		
• Develop cross sections of the Salina Formation	Month 3	Month 8
• Develop cross sections of the Greenbrier Formation	Month 3	Month 8
• Develop cross sections of the Keener to Berea Interval	Month 3	Month 8
• Develop cross sections of the Upper Devonian Sandstones	Month 3	Month 8
• Develop cross sections of the Oriskany Sandstone	Month 3	Month 8
• Develop cross sections of the Clinton-Medina through Tuscarora Interval	Month 3	Month 8
• Develop cross sections of the Rose Run and Upper Sandy Member of the Gatesburg Formation	Month 3	Month 8
Strategy 3: Map the thickness, extent, and structure of potential storage units in the study area		
• Map the Salina Formation	Month 5	Month 7
• Map the Greenbrier Limestone	Month 5	Month 7
• Map the Keener-Berea, Upper Devonian, Oriskany, Clinton-Medina, and Gatesburg Formations	Month 5	Month 7
Strategy 4: Conduct studies of reservoir character		
• Characterize potential storage intervals in the Salina Formation	Month 5	Month 8
• Characterize potential storage intervals in the Greenbrier Formation	Month 5	Month 8
• Characterize potential storage pools in gas-depleted sandstone reservoirs	Month 5	Month 8
Strategy 5: Develop ranking criteria for potential storage zones		
• Determine criteria and weighted priority of potential storage zones	Month 8	Month 9
Strategy 6: Recommendations		
• Rank all candidates within each category	Month 10	Month 11
• Rank the top candidates in each category	Month 10	Month 11
Strategy 7: Suggestions for engineering follow-up study		
• Make suggestions for additional field and lab studies	Month 10	Month 11
Strategy 8: Project management and technology transfer		
• Project management	Month 1	Month 12
• Final Report	Month 11	Month 12
• Technology transfer		Month 12+ ongoing

## 5) Next Steps

Action Items – see yellow highlighted text in this document.

Invoicing – Doug urged each of the states to (a) get all project invoicing up to date through the end of May ASAP, and (b) invoice MONTHLY from this point forward till the end of the project.

Data Management – WVGES is assimilating final data now for the website. Please share your final data via the ftp site immediately. As any pending work/maps/data are completed in the coming weeks, send those along as they are available.

Media Interview – Kris Carter is giving an interview to the Pittsburgh Post-Gazette today regarding our work for this project.

Next Meeting Date/Time – July 10, 2017 from 10 am – 11 am.

Meeting adjourned at 11:10 am.