

9/18/2020 Meeting Questions

- What are the **main objectives** or requirements for this device to be considered complete/successful? **Separate large sand from fine sand with at least 75% segregation while maintaining effective washbox operation.**
 - What are the **primary contaminants** (microbes/chemicals/solids/etc.) of concern that the filter should remove during the filtration process?
 - **Solids are the primary contaminants and are composed of native solids and iron hydroxide precipitates**
 - What is the required or target **filtration rate** and sand volume of the filter?
 - **The current minimum up flow wash water rate is 1.8 gallons per minute (gpm), meet or reduce this rate.**
 - **The bed turnover rate is 0.7 to 1.4 inches per minute**
 - **Total filter sand volume is approximately 0.6 cubic meters**
 - Do we need to concern ourselves with the related **pretreatment** processes (biochar integration)?
 - **No, the scope is limited to washbox operations and particle sorting.**
- What are the **dimensional/size** requirements of the design as a whole or of specific components?
 - **The prototype will need to fit within a test apparatus which we will need to collaborate on the design requirements for over the next couple of weeks.**
 - **A final version must fit within or attach to the existing filters as a direct replacement.**
- Is there a specific **control system, programming software, or design software** that you would like us to use?
 - **The existing system does not have control system or electronics, the sand flow is regulated by the airflow into the central column assembly. Any geometric modelling system (Solidworks, AutoCAD, Rhino3D) will work for design. Rhino3D + Grasshopper will be our internal design software with flow modelling accomplished in an OpenFOAM environment.**
- Are there only limited types of **materials** or filter media which can be used for the device?
 - Are there preferred/suggested materials?
 - **Colorado Quartz is the granular filtration media used in the filters**
 - **These are specification sheets:**



Colorado-Silica-Sand.pdf



CNC 1630.pdf

Commented [BM(1): This value needs to be an active conversation, the separate the sand sizes. To what degree may require experimentation, the more fully separated the better.

- Silica sand grain media size?
 - The large grains are on average 1.05 mm and the fine is 0.85 mm 10/20 and 20/40 stand out as the size ranges (verify by screening).

US Sieve Size	Tyler Equivalent	Opening	
		mm	in
-	2½ Mesh	8.00	0.312
-	3 Mesh	6.73	0.265
No. 3½	3½ Mesh	5.66	0.233
No. 4	4 Mesh	4.76	0.187
No. 5	5 Mesh	4.00	0.157
No. 6	6 Mesh	3.36	0.132
No. 7	7 Mesh	2.83	0.111
No. 8	8 Mesh	2.38	0.0937
No.10	9 Mesh	2.00	0.0787
No. 12	10 Mesh	1.68	0.0661
No. 14	12 Mesh	1.41	0.0555
No. 16	14 Mesh	1.19	0.0469
No. 18	16 Mesh	1.00	0.0394
No. 20	20 Mesh	0.841	0.0331
No. 25	24 Mesh	0.707	0.0278
No. 30	28 Mesh	0.595	0.0234
No. 35	32 Mesh	0.500	0.0197
No. 40	35 Mesh	0.420	0.0165
No. 45	42 Mesh	0.354	0.0139
No. 50	48 Mesh	0.297	0.0117
No. 60	60 Mesh	0.250	0.0098
No. 70	65 Mesh	0.210	0.0083

- Does the device need to have a specific **finish** (e.g. painted, galvanized, coated, etc.)?
 - Chemical and corrosion resistance are necessary (ozone and pH ~4.5), the current model is gel coated fiberglass with PVC internals, HDPE is acceptable.
- Does the device need to be **dust- or waterproof?** If so, how much ingress is allowed?
 - The system must not allow contaminants to enter the water or contain lead or mercury
- Does the system have any specific **ergonomic** requirements, such as:
 - Limited force a human operator can apply to certain components
 - Single person lift (<40 lbs)
 - A certain height or position of operator interfaces making them easy to use
 - The current system is just above waist-level and within arms reach which works well for adjustments.
- What is the target **reliability** for the complete system (quantified in % or Mean Time Between Failures)?
 - The system must be continuous operation with routine maintenance of no more than 30 minutes per week,
- What is the target **useful life** for the product (in hours/years/volume filtered)?
 - Typical installations last 5-8 years and often last longer before rebuild is necessary

- How much do you think a customer would pay for the product (i.e. target price or cost)?
 - A fullscale washbox assembly with fiberglass forming and fabrication costs in the range of \$5,000 for the first version including forms but they are reusable so consider it to be half that.
- What **methods and materials** should we be using to effectively test our design prototypes?
 - Functional analysis leading to conceptual and embodiment design followed by first generation proof of concept testing, field verification studies at pilot scale are possible but time constraints may preclude this.
 - A mutually designed test apparatus will be need fabricated (we can send out to external if needed) to aid in visualization and flow verification – construction will be similar to the current demo unit stored in JML Bay 83



- Any **common flaws** or concerns with projects like this that you think we will run into and can give advice on how to resolve or avoid?
 - The current washbox requires complete shutdown for maintenance and adjustment, modular forms are possible and very early proofs have been conducted to verify