What Features Do You Need In Your Mobile Or Modular Laboratory?

Today's need for laboratories crosses many industries in a variety of ways. This is driven by numerous factors, but most notably by regulatory compliance requirements and the need to increase the efficiency of operations. Whether the need is for a mining operation's compliance covering storm water quality or an oil/gas company running geochemical operations on well fluids to increase production, the application of a quality laboratory can have a significant positive financial impact on a company's operations. Laboratories, however, can represent a large capital expenditure and it is important to select the right team to design and manufacture. The right solution for your application starts with sound planning based on your specific needs.

An entity that is in need of their own laboratory has several options to meet their needs. A modular laboratory provides a fixed laboratory that meets or exceeds conditions provided by a conventionally-built building but with the advantages of shorter project duration. Equally important, their quality is not dependent upon the capabilities of local builders. This is particularly advantageous when the laboratory is to be located in an underdeveloped or remote location. Modular laboratories can be made from shipping containers or more traditional constructed modules. Mobile laboratories provide an option that is traditionally mounted in a van, truck or trailer and allows for use in multiple locations. These mobile facilities can provide all of the capabilities of a fixed laboratory but in a robust, moveable platform able to serve multiple locations.

Laboratories that are deployed to the field often are located in remote or harsh environments. This can include distant and undeveloped locations where much of the world's natural resources are located. Many of these locations have other challenging factors such as high/low temperatures, prone to natural disasters, unreliable power sources, high winds, dusty conditions, etc. All of these factors place additional demands on a laboratory maintaining a suitable space for performing sensitive analyses that are critical to the company's bottom line. Additionally, if the need is for a mobile laboratory, movement over rough, unpaved roadways places increased stress on the laboratory structure itself as well as the analytical equipment contained within it. The cumulative effects of repeated movement of a mobile laboratory over rough surfaces can have a deleterious effect on a poorly constructed laboratory, making selection of a quality provider even more critical.

The ultimate design of a mobile or modular laboratory, which will properly meet the needs of the end user, will have to take into consideration some key design elements. For this reason, the engineering capabilities of the manufacturer are critical. Those that are experienced with delivering laboratories (whether they are mobile or modular) which have complicated systems and requirements will be better able to provide a robust and reliable solution for the end user. The engineering process will pull together all the key elements of the design of the lab to best meet the performance requirements that need to be achieved. The first of these elements is the construction materials that will be utilized. Some modular manufacturers utilize construction techniques that are similar to those used for portable office/classroom buildings and may not be able to withstand the travel to an off-road work site. These types of buildings use wood framing and are substantially less durable than those that utilize metal framing and metal panels. For laboratory environments that demand durability, it is best to avoid any

wood in the construction of the laboratory. Those manufacturers using all metal framing or refrigerated shipping containers (which do not contain any wood) for modular laboratories produce much more durable facilities that will better withstand transport. Additionally, laboratories using wood and which are placed in high humidity or high rainfall regions can be subject to mold and rot if there is any moisture infiltration. This can shut down a laboratory and require expensive remedial work. All metal construction, on the other hand, is much more durable (with shipping containers the most durable) and is virtually unaffected by moisture. Interior material selections also can contribute to the durability of the laboratory. There are many different flooring systems that laboratories can utilize, but the two most common are welded seamless sheet vinyl and epoxy. Some laboratories employ vinyl composite tile (VCT) systems which are not suitable for laboratory environments as they are not sealed systems. Walls need to be easily cleaned and able to withstand the rigors of daily operations in the lab. Fiberglass reinforced panel systems are an excellent choice for walls and provide many years of service. Sheetrock systems are not suitable for laboratory environments as they are easily damaged and difficult to clean.

Another critical design element is the HVAC system that will maintain proper environmental conditions in the laboratory. Poor HVAC design is very common and can cause a variety of problems including condensation/moisture, improper balance, lack of temperature control and a failure to exhaust a sufficient volume of air resulting in safety issues. The engineering capabilities of the manufacturer are extremely important to ensure a proper laboratory environment that is not impacted by moisture, temperature and contaminants and ultimately compromise testing results and the life of sensitive analytical equipment. Depending on the work to be performed, laboratory safety concerns and other design factors, a user may require single pass air. These systems do not recirculate any of the air in the lab with 100% of all supplied air exhausted from the facility. The single pass scenario may be required for safety reasons (work with volatiles) or because a significant volume of air is already going to be exhausted through fume hoods. The downside of single pass systems is that they require larger (and more expensive) cooling systems, air handlers and exhaust fans. There is also an operational cost as there is no heat/cooling recovery through recirculated air, thereby increasing electrical costs. A system that recirculates air within the facility will be less expensive but not offer the degree of safety that a single pass system offers by removing fumes from the lab not captured by a hood. Some facilities may require a finer degree of filtration of their supply air so as to create a cleaner environment and reduce the chances of any contamination of samples. This would be a step below those standards as set by the federal governments of a number of nations around the world (most notably the US and Great Britain) for “clean rooms”, although “clean room” standards are also possible in mobile and modular platforms.

The need for primary containment systems (fume hoods and biological safety cabinets) also has significant impacts on cost, airflow and space. Each of these devices will (typically) exhaust a volume of air from the lab which can result in resizing air handling systems to accommodate the volume of exhausted air. It is very important to analyze the need for primary containment equipment and adjust the design of the HVAC system accordingly to account for the use of hoods.

Durability of casework is particularly important for applications in modular and mobile laboratories. Casework made from wood-based products will be more prone to warping, deflection from the stresses of transportation and more susceptible to damage from moisture. All bench top surfaces should utilize

a surface that will resist damage from the chemicals or temperature extremes generated by equipment that will be utilized in the lab. Casework made from stainless steel with properly specified chemical resistant bench tops will provide the best longevity. For mobile applications it may be important to provide a dampened surface that will absorb the shock of over road travel to protect sensitive and costly analytical equipment. Another important element with mobile laboratories is overall weight so coated aluminum casework will save weight and still provide durability and chemical resistance.

There are a number of special systems that are also options for mobile and modular laboratories that need to be considered. Building automation systems (BAS) are very useful for a fine degree of control of lab environments or those with complex HVAC systems, but can be costly. Some facilities require fire alarm systems which can also be tied in with fire suppression systems. For fire suppression there are also several options based on the type of fire threat and equipment housed in the labs. In addition to fire, some labs opt for specific gas detectors to warn of leaks of these gases in the lab. If security is a concern, intrusion alarms and CCTV can also be added to enhance security.

Determining which features an end user needs should be chosen through a lab planning session with an experienced representative of a quality manufacturer. During this phase, the end user's intended use, environment, future plans, analytical equipment and workflow are all considered in the ultimate design of the facility. Off-the-shelf designs may work for some users but be unsuitable for others. HVAC systems must be carefully designed for maximum operational efficiency of the lab as well as for safety considerations based on the work to take place in the lab. The type of construction utilized should be based on the durability and longevity required by the end user. A lab (mobile or modular) that is intended to be used for a very short duration may be able to utilize cheaper materials, provided it can survive transportation to the site, but most mobile and modular applications need the most durable materials that can be utilized. This will ensure the longest life, and when amortized over that life, the lowest annualized cost of the facility. Unfortunately, it is not feasible to provide a one-size-fits-all approach to mobile and modular laboratory design, as its ultimate ideal set of features will vary with the end user's needs. We can, however, lay out design parameters for certain types of laboratories. Most modular and mobile laboratories should incorporate designs that do not utilize wood in any part of their construction, including casework. HVAC systems will vary, but many laboratories performing sensitive analyses and those utilizing volatile chemicals will require single pass air systems. All other finishes in the lab should be as durable as needed for their particular application taking into account types of chemicals, any extreme temperatures (high or low) and mechanical loading (such as with strength testing equipment). These factors will help determine whether a facility should utilize an epoxy or welded sheet vinyl system. Needs for primary containment will also be determined by the end user's intended work and will need to be considered. Finally, special systems such as BAS, CCTV, fire and intrusion will need to be selected or omitted based on a risk assessment of the facility.

In conclusion, the final design elements of a mobile or modular laboratory depend heavily upon the intended application of the lab, the environment in which it is to be operated and a risk assessment that includes lab safety, fire safety and security threats to the laboratory. It is critical for any end user selecting a laboratory manufacturer to carefully consider the level of expertise of the manufacturer.

They will be able to guide the end user to a final design that is best suited for the end user's needs so that they ultimately receive a functional laboratory that has not been over- or underdesigned.