2011

TECHNICAL ASSIGNMENT 1

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Construction Management
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Executive Summary

The Biological Research Lab is an Animal Biological Safe Laboratory (ABSL-3) located on the Pennsylvania State University Campus. The laboratory's design of a modern barn captures the nature of the surrounding facilities. Making up the façade, the rusticated concrete masonry units, metal roof and unique windows fit with the agricultural part of campus while providing a high efficiency building envelope. The facility as seen in figure 1 is approximately 20, 330 square feet and has a scheduled cost of $23 million which is funded by the National Institutes of Health (NIH) along with Penn State.

Figure 1 - Courtesy of Payette Associates

The Building is comprised of three floors plus a basement; research will take place on the ground floor while Air Handling Units are located above, and the chilled water system and hydronic (boiler) system below in the basement. Other systems that are included in the mechanical penthouse are the effluent decontamination system, electrical and plumbing. Due to NIH standards the research laboratory was designed to meet construction and redundancy standards for ABSL-3 facilities. The U.S. Green Building Council is a organization that promotes sustainability in how buildings are designed and constructed. The new Bio-Research Lab is currently seeking the level of LEED Silver just above LEED Certified which is mandatory for all new construction on The Pennsylvania State University campus. The new facility will achieve this rating through concepts such as utilizing recycled materials and local materials to construct the new building.

This report's breakdown will emphasize only the construction of the Biological Research Laboratory. A project schedule, building systems summary, project cost evaluation, existing conditions and site plan will be analyzed in this technical report on the ABSL-3 lab. The technical report also contains key information on the owner and the needs for building this type of facility. Torcon Inc., the chosen construction manager of the project, will also be described in the report, as well as a staffing plan introducing the project team. A brief narrative on the project delivery method is also included, showing the different parties involved with the project.

After the conclusion of the first technical analysis, examining contractual agreements, the construction schedule, along with the budgeted funding all play a large role in the successful completion of the project. Most of the funding from the project comes from an NIH grant. If work is not preformed as per their design requirements they could possibly stop payment on the rest of the scheduled funding the University is supposed to receive. The construction schedule plays another large role in purchase ordering and planning for the long lead time with lab equipment. The Design – Build method could have shortened the design as well as construction if implemented by the University, benefiting the project over time.

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Project Schedule Summary

The Research Facility at the Pennsylvania State University was placed on hold and changed designs a series of times. Preconstruction for the project with the latest additions to the design carried a duration of approximately 5 months. The notice to proceed process was approximately 18 days until the construction phase began. Construction started in late August of this year and is projected to finish at the end of January 2013 with a period of 13 months for construction.

During the start of the construction phase, mobilization took 16 days to have a trailer on site, connect temporary utilizes and put up a site fence. The removal of top soil and bulk excavation followed in preparation of the foundations and footers. The foundations were staged in two completions; the first was the west and south walls of the facility, followed by the north and east. After the foundation was placed, the electrical trades start to implement conduit underground in the basement of the lab floor for the mechanical equipment that will be added later.

Once the forms were removed from the first foundation walls and have been cured, the steel erection process began. The steel erection began to make progress down the length of the building, with a second crew placing the composite metal decking behind. After all of the necessary equipment has been placed in the basement, the slab on grade is poured, which supports boilers and other equipment, while the steel crew is in the process of installing roof sheathing. When the sheathing is being placed, exterior walls should be placed along with the cold form metal stud walls to enclose the structure from the elements.

Throughout the project there are many finishes being completed both on the outside of the building and on the inside. Sidewalks and new asphalt roads are being installed around the laboratory while laborers are finishing hanging gypsum wall board inside. One of the interior finishes that is absolutely crucial are the finishes of the floors and the walls. The floors and the walls need to have a smooth, crack and hole resistant finish, as seen in figure 2, to prevent material and bacteria from compromising the surface. The last important task to ensure the facility will operate correctly is placing the lab equipment throughout the building. While lab equipment is being installed, the final grading and landscaping will finish up to turn over the laboratory to the user.

Figure 2 - Courtesy of Jeff Spackman

Building System Summary

	Building Systems Summary	
Yes	Scope of Work	NO
X	Demolition	
X	Structural Steel Frame	
X	Cast in Place Concrete	
	Precast Concrete	X
X	Mechanical System	
X	Electrical Systems	
X	Masonry	
	Curtain Wall	X
X	Support of Excavation	

Table 1

Demolition

Removal of material from the site will consist of existing utilities lines that lie within the construction fence. These utilities will be relocated around the building footprint or just removed depending on their prior purpose.

Structural Steel Framing

The first floor was comprised of a 2 inch metal composite deck with 2.5 inches of lightweight concrete. The steel throughout the structure will be comprised of both HSS4x4x4x3/8 as well as a series of wide flanged columns, W8x31 being the most commonly used. The beams in the structure are also supported by a series of hollow core structural steel as well as different types of wide flanged beams. The roof is comprised of a 1 1/2 inch metal decking that is supported by joists and the joists transfer the load to the beams and ultimately the columns which is a typical loading path for this building. On the site a mobile crane will be used to perform the steel erection process.

Cast in Place Concrete

The building footprint sits on a series of reinforced spread footings for the steel columns where the spread footing reinforcement extends into the column footing. The other form of structural support for the building is continuous footings which support the concrete wall, CMU and split-faced block walls. According to the geotechnical survey of the site, the wall footings and column footings must be 18 and 24 inches respectively to avoid punching shear failures. Below the column and wall footers was a soil of 3000 lbs/sq ft. or if soils were not approved in the location of the foundation, an eight-inch compacted sand buffer placed over rock must be utilized. A minimum of a six inch slab was used for the basement floor which sat on 4 inches of compacted stone. The foundations walls are reinforced and modular slab form is used to cast the concrete walls.

Mechanical System

The Biological Research Lab is based upon NIH and Association for Assessment and Accreditation of Laboratory Animal Care (AAALAC) standards for interior cooling loads because of storage of animals inside the facility. The regulations were only applied to the labs and holding rooms inside the facility while ASHRAE was used for all of the remaining design conditions that were not addressed with NIH or AAALAC standards. The building utilizes two air cooled chillers supplying 44 degree Fahrenheit water to the five main Air Handling Units throughout the building. The chilled water pumps also have variable frequency drives for maximum flexibility with the pump/chiller operations. These five main Air Handling Unit's have heat recovery coils for 100% outside air units which supply fresh air to the containment labs. Along with the Air Handling Unit's, there are a series of fan coil boxes with no humidifiers to circulate air throughout the facility in the mechanical rooms, stairwells and corridors.

The hydronic systems in the research laboratory consist of two boilers rated to be 100% of the winter capacity which is the peak load for the building. The boiler pressure is 100psig and will be delivered at that pressure to the decontamination system. The effluent decontamination system used in the Animal Biological Safe Laboratory is a combination of steam and chemicals which completely destroys the targeted bacteria or pathogens. The system is applied to waste which is tested within the biocontainment lab. Using pressure reducing valves steam will be lowered from 100psig to 80 psig to supply and used as process steam throughout the building. The preheat, heat exchangers, humidifiers and heat exchangers utilize pressure reducing valves to reduce the 80psig steam down to 15 psig to serve the equipment.

Electrical System

The electrical service into the building will be a 480Y/277 service that feeds a 1600 Amp double-ended switchgear. The power flows downstream to a pair of 1200 Amp switchboards which are fed from separate sides of the 1600 Amp double-ended switchgear. These two switchboards will supply the power to the mechanical, lighting and receptacle panel boards. The panels boards for the ABSL3 and BSL3 will be supplied from different panels located outside the containment barrier. The service for the facility will be calculated as sized not only for the anticipated load but will include an additional 25% capacity for growth. A generator will also be placed on site for standby/emergency and all life safety loads will be redundantly wired alongside with normal power in case of an emergency.

The interior lighting will consist of high efficiency Light Emitting Diode fixtures and T8 fluorescent lamps placed in corridors and common areas. Lighting in all animal rooms will be individual controlled and have scheduled cycling which are all independent of each other. Throughout the facility emergency lighting will be placed, connected and powered by the life safety system. All of the luminance levels follow the IESNA and NIH requirements.

Masonry

The exterior masonry on the ABSL-3 is a CMU decorative veneer. The wall type will have a two inch air space behind the wall along with a two inch piece of polystyrene rigid insulation with an expected R-Value of 10. The wall is supported by hangers that attach to a cold formed steel stud wall, as seen in figure 3.

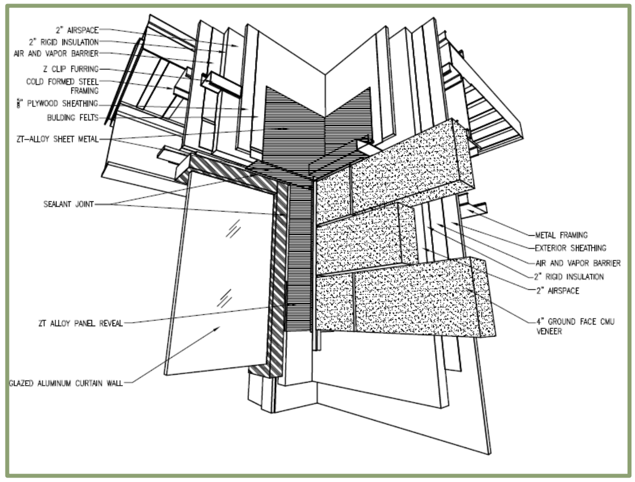


Figure 3 -Courtesy of Payette Associates

Support of Excavation

The location of the site is on a slope with the grade level of the building in the front and an exposed basement to the rear. Excavated material towards the back of the building only needs to be below the frost line of the ground. The back of the building does not need to be supported with a trench box or benched walls because the excavated height is below 5 feet. The front and sides of the building utilized a benching method to comply with safety regulations when placing the footers and foundations. A geotechnical survey was also performed on the site and found no high water tables in the area which prevented the need for dewatering systems.

Project Cost Evaluation

The Estimate Provided by Torcon, the construction manager, was given to the owner representative, Office of Physical Plant (OPP), to show system costs as well as the cost of construction. These values do not represent the subcontracts on the project. The values however can be assumed to be within a reasonable range in relation to the actual estimate for the project.

General Project Information		
Square Footage of Project	**20,330 SF**	
Construction Costs	**Actual**	**Cost/SF**
Actual (without general requirements):	$ 15,541,043.00	$ 764.44
Actual (with general requirements):	$ 16,672,993.00	$ 820.12
Total GMP Cost:	**$ 23,000,000.00**	**$ 1,131.33**

Table 2

Building System	Actual Cost	Cost/SF	% of Building
Concrete	$ 782,891.00	$ 38.51	4.30%
Masonry	$ 93,381.00	$ 4.59	0.51%
Structural Steel	$ 510,670.00	$ 25.12	2.81%
Metal Panels	$ 555,930.00	$ 27.35	3.06%
Glass and Glazing	$ 344,415.00	$ 16.94	1.89%
Fire Protection	$ 98,098.00	$ 4.73	0.53%
Plumbing	$ 1,194,547.00	$ 58.76	6.57%
HVAC	$ 3,876,351.00	$ 190.67	21.30%
Electrical	$ 1,921,420.00	$ 94.51	10.56%

Table 3

Square Foot Estimate R.S. Means Costworks Square Foot Estimate

The ABSL-3 Laboratory that is being constructed at the Penn State University has many intricate and redundant building systems in order to comply with NIH standards (National Institutes of Health). In this specific case, because of the complexity of the research facility, it was hard to achieve an accurate estimate using *R.S. Means Costworks*. The square foot estimate asked basic information, for example building type, location, date of construction, type of wall construction, but has very limited capabilities in regards to a research facility of this caliber. R.S. Means only accounts for a basic laboratory not an Animal Biological Research Lab which is one solution to why the cost varies from the winning bid.

In my estimate as you can reference in table 4, the basic information for a total cost of $ 3,991,500.00 and a building cost per square foot. Some of the problems that occurred with the estimate and its inaccuracy of more than 19 million is *R.S. Means Costworks* only accounts for these laboratories as a single floor. The actual building is three floors above grade along with the basement below. Another large discrepancy dealing with cost is equipment and the different types of building systems. The R.S. Means uses a basic laboratory while the Biological Research Lab has redundant mechanical and electrical systems which make up a large difference in the cost of the project. HVAC in the R.S. Means calculation is not even included for the College Laboratory building type. The estimate, which can be referenced to appendix B-1, calculates utilities in the facility to be $ 9.95 per square foot where in the approximate detailed estimated, a total system estimate of $ 343.94 per square foot is used according to table 3 above.

The R.S. Means Costworks estimate of the project is not accurate and does not project the evaluation of the cost of the building, falling outside of the +/- 20 percent of the actual cost of the project as seen in table 4.

RS Means Cost Estimate Report	
Building Type	**College Laboratory**
Structural Makeup	Face Brick with Concrete Brick back-up / Steel Frame
Location	State College, Pennsylvania
Story Count	1
Story height	12'
Floor Area (S.F.)	20,330.00
Labor Type	Union
Fiscal Period	Year 2011 Quarter 3
Basement Included	Yes
Total Building Cost	$ 3,991,500.00
Cost per Square Foot	$ 196.63

Table 4

Assemblies R.S. Means Costworks Estimate

The assembly estimate for the MEP systems was evaluated through the R.S. Means Costworks online database. Some of the basic information was the location as well as the time when the material was purchased and installed. Looking at the plumbing, all of the major fixtures were accounted for throughout the building including lavatories, urinals, sinks, shower stall, and emergency electric water heaters. Other equipment that was added was a recessed electric water cooler located in the facility which can be referenced in appendix B-2.

Fire protection were also considered in the assemblies estimate. Upon examining the drawing a combination of wet and dry systems was used throughout the building, but the majority was to be a dry sprinkler system in the labs to avoid the contamination of water. The places that a wet system were utilized was in stairwells and non-essential hallways in the facility. An Extra Hazard level system was also assumed to be in the building but through further investigation, a normal system was actually designed for the building elevating the cost estimate preformed.

Mechanically, the assemblies estimate was not accurate at all because of the type and complexity of the facility. There is an abundance of equipment such as humidifiers, reheat colds, economizers, chilled water skid, heating hot water skid, variable frequencies drives for pumps, and expansion tanks that were not taken off in the estimate of the system. Some of the larger pieces of equipment were accounted for in the takeoff such as the redundant boiler system, 6 main AHU's, fume hoods and fan coil boxes to circulate the air throughout the building which can be referenced in appendix B-2.

The electrical system in the research laboratory was also difficult to quantify. A total number of fixtures in the structure were accounted for as well as the receptacles in the building. The multiple feeds into the laboratory as well as the double switch board panel proved to be difficult quantify and takeoff. The amount of wire, transformers, and distribution panels proved to be hard to classify because of the large number of choices in the estimate.

Estimate Conclusion & Comparison

Comparing the Actual and R.S. Means data resulted in two different figures for a college laboratory as seen in the table 5 below. The estimated square footage cost was extremely low compared to the actual cost including general conditions. Square footage estimates should typically as stated above in the discussion, have an accuracy of +/- 20%. In the case of the ABSL-3 laboratory, the intense mechanical and electrical systems cannot be accounted because of all of the NIH safety guidelines.

Estimate Cost	Total Building Cost	Total Square Foot Cost
Actual	$ 16,672,993.00	$ 820.12
R.S. Means	$ 3,991,500.00	$ 196.63

Table 5

The assemblies estimate, while difficult to compare, seems to be a within a realistic range when viewed next to the estimate for the actual estimates for the building systems. The plumbing systems were calculated to be relatively close from the table 6 below. The original estimate for plumbing was $1.2 million compared to $115,000 which seemed to be an outstanding difference at first. Upon viewing the takeoff list in the detailed estimate a $1 million decontamination system was added into the plumbing cost and was later removed in table 6 below to obtain a more accurate Cost/S.F. with a difference of $3.72/S.F. The Fire protection system seemed to be also relatively accurate with a cost difference of 1.27 cents/S.F between the two estimates, having a total cost of $4.73 per square foot compared to the estimate $6.00 per square foot. One assumption that was made during the assemblies estimate for the sprinkler system was the hazard level was over estimated inflating the cost. If the estimates were to be recalculated using an ordinary hazard level, the cost/S.F. would have been even closer.

Mechanical and Electrical Systems estimates, due to unique features of the laboratory, seemed to skew and proved difficult for R.S. Means. The mechanical system intricately designed with redundant AHUs, lots of ductwork, and monitoring sensors that could not be accounted for in the estimated resulting in a 77% difference in cost/S.F. The electrical system was similar in the outcome of the cost approximation with a large difference from the actual cost projected. The estimated difference between the two estimates as seen in table 6 below is 64% with respect to cost/SF for the electrical systems. The assemblies estimate for normal systems proved to be somewhat accurate in determining the cost/SF but for unique systems Costworks, provided by R.S. Means, proved to be inaccurate and unreliable.

MEP Systems				
	Actual	Cost/SF	Assemblies Estimate	Cost/SF
Plumbing	$ 1,194,547.00	$ 58.76	$ 114,306.13	$ 4.91
Influent Decontamination System	$ (993,500.00)			
Plumbing Total	$ 201,047.00	$ 8.63	$ 114,306.13	$ 4.91
Fire Protection	$ 98,098.00	$ 4.73	$ 122,064.00	$ 5.24
Mechanical	$ 3,876,351.00	$ 190.67	$ 890,175.46	$ 38.20
Electrical	$ 1,921,420.00	$ 94.51	$ 425,745.32	$ 18.27

Table 6

Existing Conditions

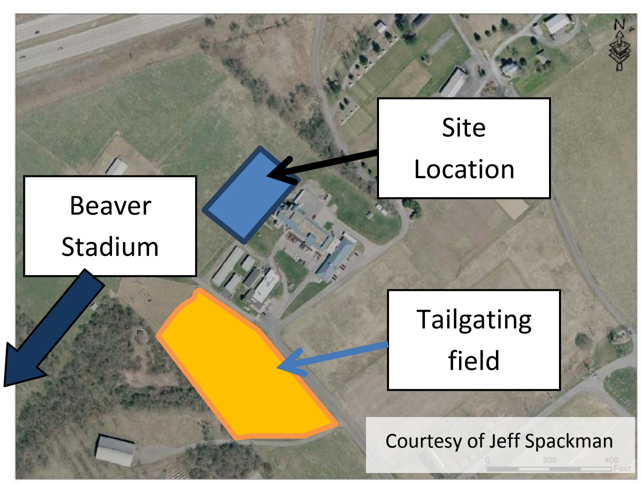
The Biological Research Laboratory, on The Pennslyvania State University's main campus, is located in the agricultural area of campus north east of Beaver Stadium (below) in figure 4. The location was deteremined based on other similar facilities that are present in the general region. The contour on the site contains a gradient of 20 feet sloping down to the back of the proposed construction location. An environmental assessment also had to be performed on the site for the National Institute of Health (NIH) in order to receive grant money for the project. One of the stipulations for the environmental assessment was an archeology study of the disturbed area. The archeology was used to help determine the Biological Research Lab's effect on the environment.


Courtesy of Jeff Spackman

Figure 4

The actual site itself has major utilities that need to be modified in order to place the Laboratory in its desired position. Animal fencing for cattle grazing needs to be removed around the site to make room for the approved blue wind screen fencing by the university. The building foot print lies directly on a cow pasture with an abundance of irrigation and other utility lines as seen in appendix C. As per design requirements, all the utility lines that lie in the construction zone must be remove and relocated. More importantly is the existing sanity sewer line that runs in the construction area which is planned to be capped, removed, and redirected. Another utility underground that needs to be removed is a water line which falls directly under the building foot print of the Biological Research Lab.

The area is also a concern for pedestrian traffic through the site during football games (below) Figure 5. The Laboratory has a close proximity to the stadium as well as sits adjacent to current tailgating fields. Due to public safety during construction the fence around the site will be secured and locked anytime there is no competent person on site.



Courtesy of Jeff Spackman

Figure 5

Site Layout Planning

In preparation for excavation plan (Appendix C-1), a site fence was placed around the construction area to enclose further work from the general public while maintaining all university protocols. Torcon, the Construction Manager on the project, placed their trailer near the gravel road leading up to the site. One of the first delays on the site involved getting temporary utilities to the trailer. On the site for the excavation phase will be dump trucks, bull dozers, and excavators preparing for foundations and the superstructure.

The soil stock pile will be located in the back corner of the site remaining out of the way for the duration of the project. One reason why the topsoil stock pile was placed in this region was to prevent labor and equipment moving material twice. During this phase a new parking lot was added, ultimately to be a paved lot for faculty parking at the facility. Temporary lighting was also provided in this lot for safety reasons. Material storage trailers are also placed on site and used by the sub-contractors for storage and equipment while working on the project. In an effect to make work more productive during the excavation phase of the project convenient bathroom locations were also planned to cut down on walking time to and from the bathrooms.

The construction of the superstructure involves moving certain equipment off site while preparing different areas for laydown in order to speed up the erection process. At the beginning of the superstructure phase, a mobile crane was introduced to the site in order to erect the structural columns and beams. During this phase the dump trucks and excavators are vacated from the site to reduce equipment costs on the project. The bull dozer, however, stays to ensure there is a solid and level base for the mobile crane as it travels around the site preforming steel picks. The site plan can be referenced in (Appendix C-2) for more detail.

Looking at the site logistics for the superstructure site plan also has changed in comparison to the previous excavation plan. First the portable bathrooms have moved to locations such as the material storage area to be closer to the work being performed. Dumpsters have also been dispersed around the site to not only comply with the LEED silver rating but also to keep the site clean with convenient locations around the building. Crane placement, material staging, and storage area was critical because it allows the project to have efficient production. The placement of the crane would have been better if place in front of the building but could not due to sloping topography. This resulted in placing the material storage and the crane behind the structure, allowing the crane to walk along the back of the building when preforming different steel picks. A downside to placing material in the back of the site is difficulty getting to and from the material storage area, slowing production.

Upon completing the project, the finishes site plan prepares and implements site re-grading and final paths for the site which can be referenced in more detail in (Appendix C-3). Bull dozers are brought back to the site in order to finish the top soil grading for final landscape and placing grass seed. Referencing the site plan the soil stock pile is split in half to increase efficiency to the left and the right of the laboratory. During this phase a compacted gravel road is installed leading up to the back of the facility. Concrete trucks are also on the site delivering material to both the front and back of the laboratory, finishing the walkways, steps and concrete pads for utilities.

The Pennsylvania State University, owner of the project, did not want to disclose the temporary services on the project. These temporary utilities were installed with every intention to be permanent. Other site changes for this phase included adding more dumpsters to account for added materials inside the building. These dumpsters were placed at the entrances to the facility as well as by the material storage area. The amount of portable bathrooms was also increased and relocated to shorten the distance for crews and increase their productivity. After the Finishes site plan the facility is ready to be turned over to the owner with only punch list items left to finish before the occupancy of the structure.

Local Conditions

Through research Centre Country does not contain any bylaws on construction. The permitting process in the region is however a bit difficult. Construction documents must be approved by the county which could take up to a couple of weeks to review. One fact about building permits in Centre Country is they do not expire so if a building is put on hold as long as the design does not change the permit is still valid. Looking at parking at the site, the construction area for the building allows for multiple parking for cars as well as a new parking lot installed in front of the proposed facility. Crews as well as the Construction Management team should have amble parking during times when peaks crews are preforming work on the structure which can be seen in Figure 6.

Figure 6

Penn State University's BRL is located in Centre Region County where they have their own guidelines for recycling and tipping fees. On the Centre County Solid Waste authority's website one can find specific prices and set weights for waste. The Fees for waste in Centre Country are priced at 70 dollars per ton for municipal waste. Recycling on the site states the removal of material is pro-rated at 5.00 per ton.

Geotechnical Report

The site of the project lies on top of Ordovician aged limestone which is a carbonate rock. As limestone decomposes it produces a variable layer of soil. Due to the irregular soil, rock condition of the site, and level of decomposition cavities or sink holes have a possibility of forming. After boring samples were taken from the site it was determined that rock was present at 1.5 to 19.0 feet below the ground. Excavating could be quite difficult in these areas and blasting, ripping, jackhammering, along with other methods might be needed to place foundations at the correct levels.

During the geological surveys no water was encountered when drilling for boring samples. The amount of stannic water on the site should be anticipated to change throughout the course of construction. The amount of water on site will ultimately be determined by the amount of precipitation, run-off, infiltration, site topography, and proper drainage. Drainage on the site should run away from the building preventing sinkholes from affecting the structure.

Client Information

The Pennsylvania State University is paving the way in infectious disease research where a lot of funding comes not only from government agencies but the NIH (National Institutes of Health) as well. The Huck Institutes of the Life Sciences, a college at the University, has been extensively hiring, funding faculty and making advancements in the infectious disease division. Over 100 faculty researchers, research associates, and postdoctoral researchers are involved with infectious disease research at The Pennsylvania State University. The University has also won many awards for their contribution in the infectious disease department from the USDA, NSF, DTRA and private Gates foundation.

Even with all of the staff employed by the University, the capacity for research with biosafety Level three (BSL-3) agents is limited. There is no ABSL-3 space, or Arthropod Containment Level three (ACL-3) space, while the only BSL-3 Space is a wet bench lab approximately 150 NSF located in the Life Science Building. An Animal Biological Safe Laboratory level 3 (ABSL-3) facility was always a goal for The Pennsylvania State University due to the increased amount of research funding. In 2007 the initial design for the laboratory was created and a preliminary site was chosen to be presented to the planning commission. The design incorporated each type of research space and with as much flexibility as possible while still following all of the constraints for a BSL-3 facility. All of the initial design steps were accepted except for the fact that the project cost estimates, which were nearly three times the amount budgeted. The immunology and infectious disease program at the University has been growing quite rapidly and in 2009-10 twelve new faculty members were recruited to work for the department.

In order for the University to build the proposed building they needed to obtain partial funding to subsidize the rest of the building cost. The National Institute of Health (NIH) which funds a lot of Penn State University's research in this area also provides grants for institutions that propose to expand, remodel, renovate, or alter biomedical or behavioral research facilities. The University allocated around $8 million from the project and through a grant from NIH which requested $15 million a total budget for the project came to $23 million making the construction of the project actually feasible.

Dealing with Penn State University their standards for quality and safety are above the rest. On all projects on campus any worker or visitor entering a jobsite must have a hard hat, safety glasses, and hard soled shoes. Also due to the Penn State Master Plan (beautification process) any construction must be surrounded with a blue wind screen fence to hide the ongoing construction from faculty, students and prospective students. The quality of work is also important to the university not so much as because of the buildings location but due to the fact that this is going to be a highly technical and unique project. The Biological Research Facility is one of the only structures in the country that's not modular or part of another building but stands on its own. Just as researchers from Penn State visited other facilities to come up with their own designs research professionals will visit Penn State University's state of the art facility. This makes quality more import because the BRL Laboratory is going to become the face of the universities research department for infectious diseases.

Project Delivery System

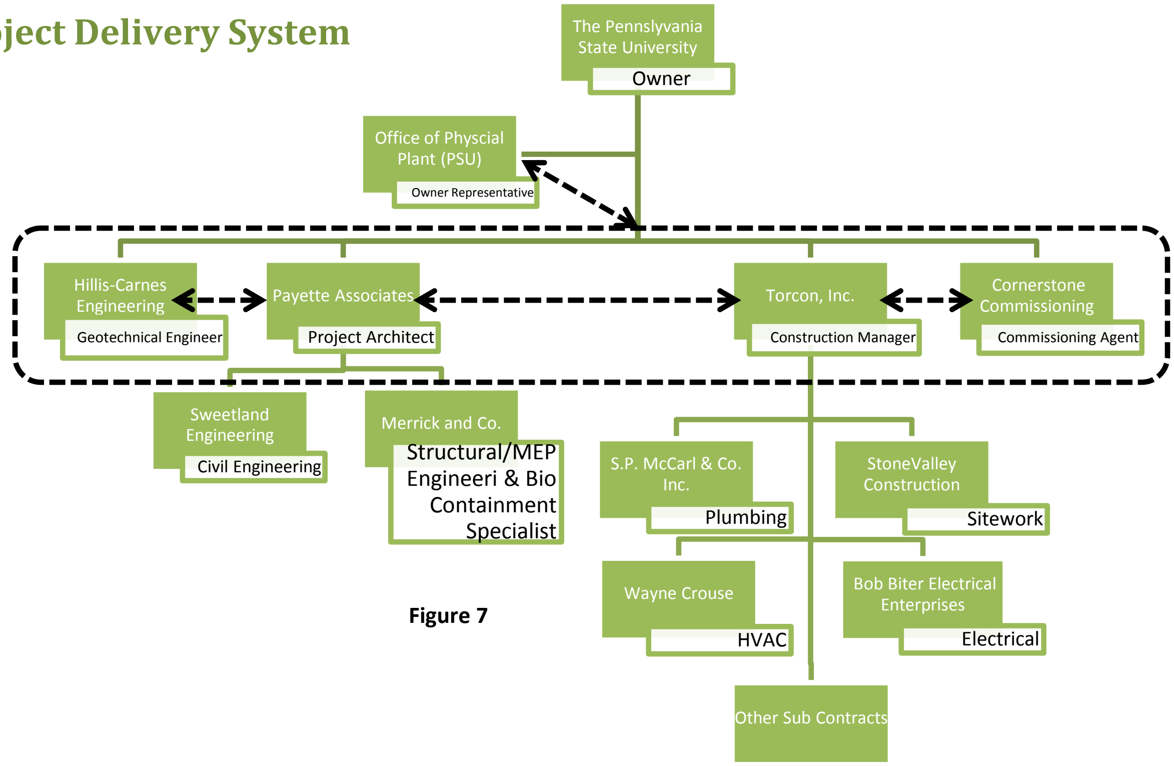


Figure 7

The project delivery method for this project at the Pennsylvania State University falls under a Design-Bid-Build contract. This being a University project, Office of Physical plant acts as a owner's representative to the University and College of Life Sciences. The project was funded from two main sources one, the National Institutes of Health (NIH) along with Penn State University making this project a Guarenteed Maximum Price bid. NIH requires, in order to receive grants for ABSL-3 facilities, to have a geotechnical survey completed along with a environmental impact study . They also require to have a commissioning agent available during the course of the project.

Many Construction Management firms submitted a proposal for the project but based on the evaluation of capable firms, past experience with the University, and knowledge in ABSL-3 facilities, only the best suited was chosen. Torcon Inc., The Construction Manager on the project, issued a Guaranteed Maximum Price for construction and bids for all of the subcontractors are awarded to the lowest, prequalified bidder. Torcon will, as the Construction Manager at Risk, hold all of the Payment & Performance bonds on the project dealing with subcontractors. The CM firm will also collaborate closely and communicates with the Architect, Commissioning Agent, and Geotechnical Engineer to deliver a valued project to the University as seen in Figure 7. These four entities will similarly have direct communication with the owner's representative, Office of Physical Plant, in regards to schedule, cost and qualtity on the project.

Torcon Staffing Plan

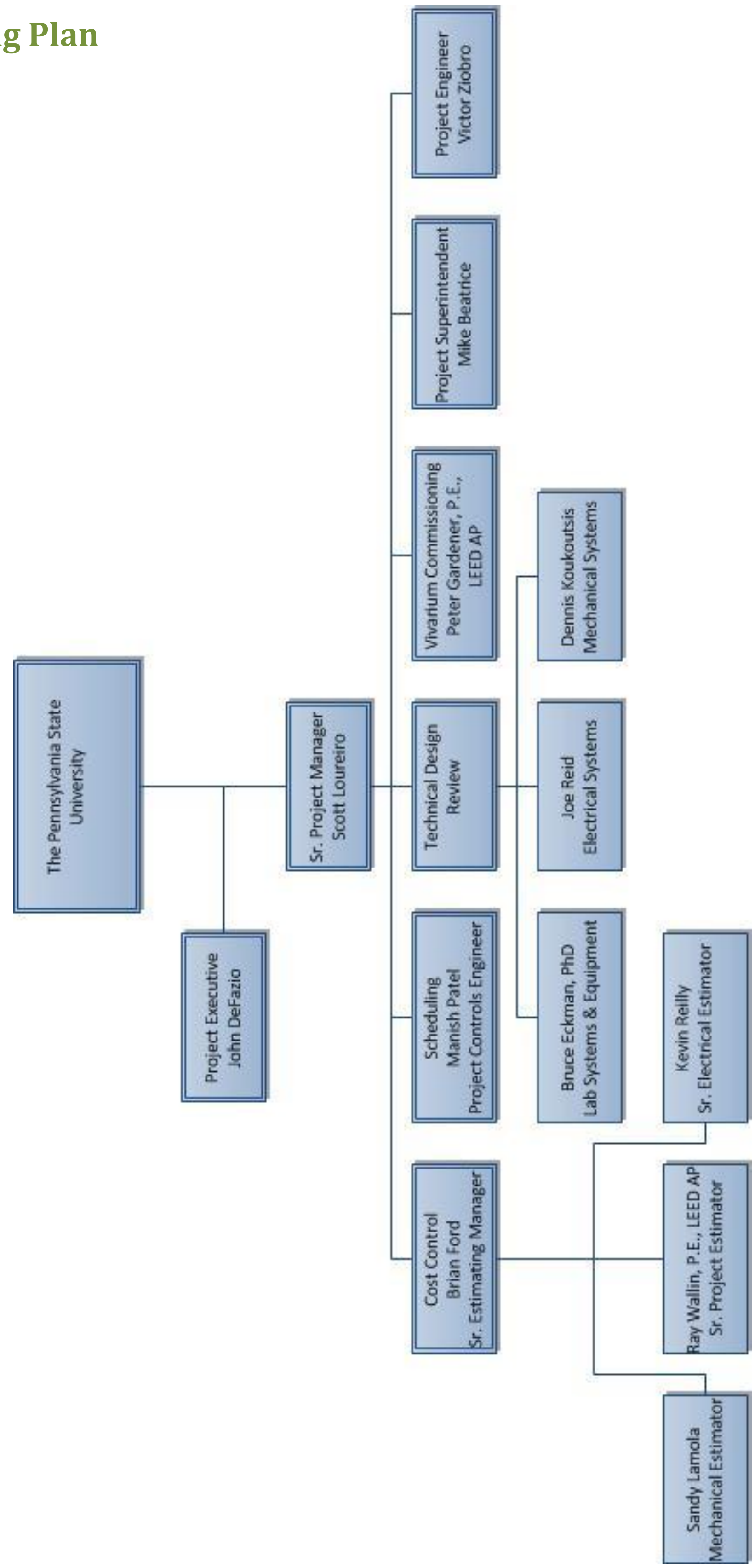


Figure 8

Staffing Plan

The Torcon construction management service was selected to complete and construct the BSL-3 laboratory on the Pennsylvania State University Park campus. Torcon has had an extensive knowledge in BSL-3 and ABSL-3 facilities, laboratories, animal facilities, and manufacturing facilities to help apply technologies in a BSL/ABSL-3 design. The project team, in Figure 8, not only understands the architectural and HVAC requirements but also has growing knowledge in Biosafety cabinets, autoclaves, cage washes, water systems, incinerators and waste handling systems.

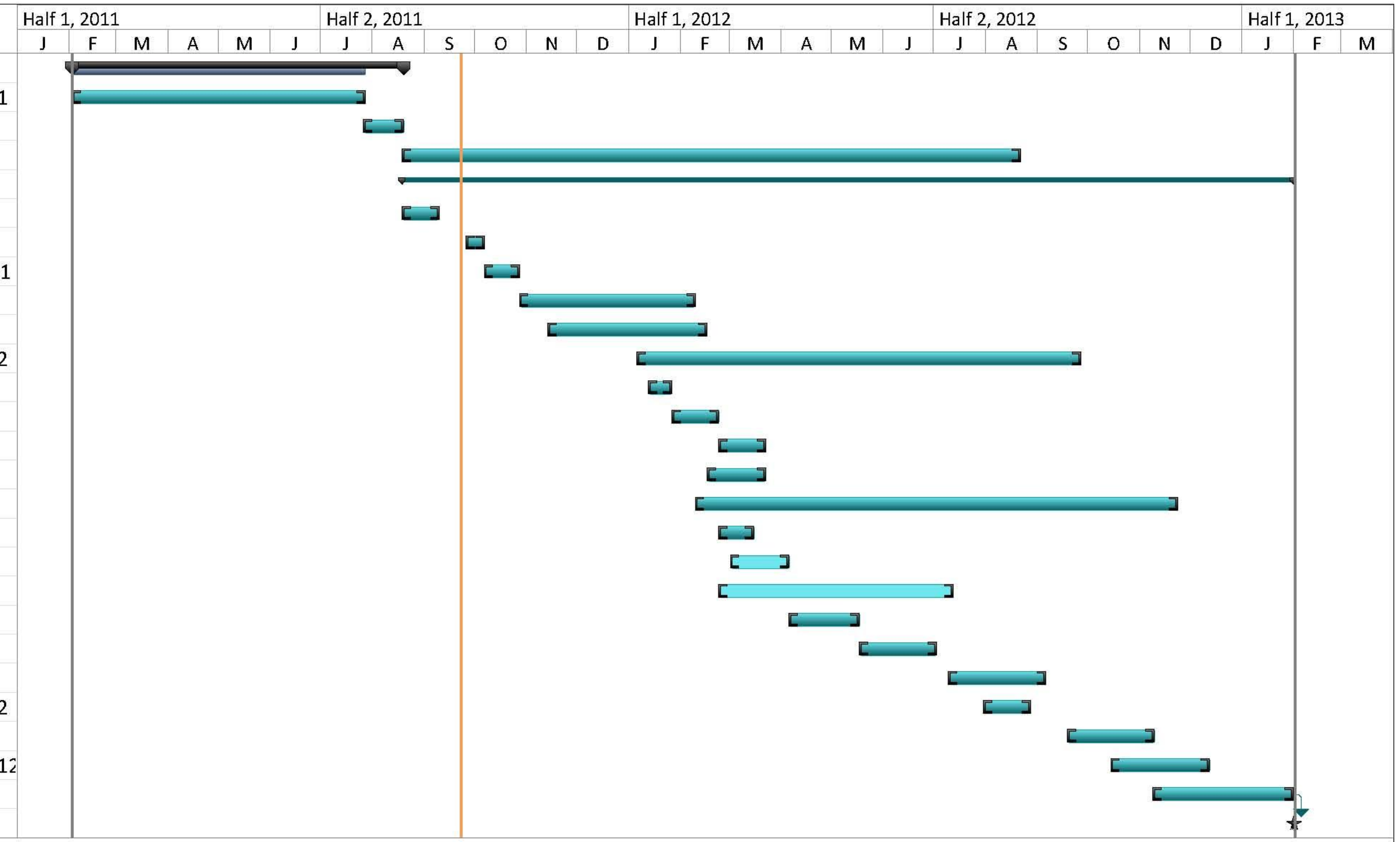
The project team's Scott Loureiro and John DeFazio will be involved with the project front the contract award untill the closeout of the project. Scott will serve as the primary contract with the University and OPP.   John will have an executive oversight and in control of all of Torcon's resources to ensure the success of the project. Within the project team is a technical design review committee that are MEP specialists with extensive knowledge and experience with similar facilities. They will be in charge of performing technical reviews to ultimately add value to the product the client is receiving. Peter Gardener who manages the commissioning and sustainability services at Torcon will be in initial design reviews where his knowledge in vivariums will be valuable.

Torcon will also provide two full time staff members at all times first Mike Beatrice the project superintendent and Victor Ziobro the project engineer. Scott Loureiro will be on site at once a week maintaining his central involvement with the project. The job conference meeting will be held every two weeks led by John DeFazio along with the rest of the Torcon Project team on sight. The job conference meeting, depending on who is present at the meeting will either be held at the site or at another location.

[APPENDIX A]

PROJECT SUMMARY SCHEDULE

ID		Task Mode	Task Name	Duration	Start	Finish
1			**Preconstruction**	**142 days**	**Thu 2/3/11**	**Fri 8/19/11**
2			Design	125 days	Thu 2/3/11	Wed 7/27/11
3			Notice to Proceed	18 days	Wed 7/27/11	Fri 8/19/11
4			Procurement	263 days	Fri 8/19/11	Tue 8/21/12
5			Construction	380 days	Fri 8/19/11	Thu 1/31/13
6			Mobilization	16 days	Fri 8/19/11	Fri 9/9/11
7			Top Soil Removal	9 days	Mon 9/26/11	Thu 10/6/11
8			Bulk Excavation	15 days	Fri 10/7/11	Thu 10/27/11
9			Footing	75 days	Fri 10/28/11	Thu 2/9/12
10			Foundation Walls	69 days	Mon 11/14/11	Thu 2/16/12
11			Electrical	189 days	Fri 1/6/12	Wed 9/26/12
12			Steel Erection	10 days	Fri 1/13/12	Thu 1/26/12
13			Decking/Place S.O.D.	20 days	Fri 1/27/12	Thu 2/23/12
14			Place S.O.G.	20 days	Fri 2/24/12	Thu 3/22/12
15			Roof Sheathing	25 days	Fri 2/17/12	Thu 3/22/12
16			Mechanical & Plumbing	206 days	Fri 2/10/12	Fri 11/23/12
17			Exterior Framing/Sheathing	15 days	Fri 2/24/12	Thu 3/15/12
18			Exterior Masonry/Insulation	25 days	Fri 3/2/12	Thu 4/5/12
19			Interior Partition Framing/GWB	100 days	Fri 2/24/12	Thu 7/12/12
20			Exterior Doors and Glazings	30 days	Fri 4/6/12	Thu 5/17/12
21			FRP Sidewalk and Asphalt Paving	32 days	Fri 5/18/12	Mon 7/2/12
22			Paint & Floor Finishes	42 days	Tue 7/10/12	Wed 9/5/12
23			Final Grading/Landscaping	20 days	Tue 7/31/12	Mon 8/27/12
24			Install lab Equipement	38 days	Wed 9/19/12	Fri 11/9/12
25			Start-Up testing	43 days	Mon 10/15/12	Wed 12/12/12
26			Commissioning	60 days	Fri 11/9/12	Thu 1/31/13
27			Turnover	1 day	Fri 2/1/13	Fri 2/1/13



Project: CPM schedule
Date: Fri 9/23/11

Task		Project Summary		Inactive Milestone		Manual Summary Rollup		Deadline	
Split		External Tasks		Inactive Summary		Manual Summary		Progress	
Milestone		External Milestone		Manual Task		Start-only			
Summary		Inactive Task		Duration-only		Finish-only			

[APPENDIX B-1]

RSMeans Costworks® 2011 Estimate Report

RSMeans Costworks® Square Foot Estimate

	Square Foot Cost Estimate Report	
Estimate Name:	**Biological Research Laboratory**	
Building Type:	**College, Laboratory with Face Brick with Concrete Brick Back-up / Steel Frame**	
Location:	**STATE COLLEGE, PA**	
Story Count:	**1**	
Story Height (L.F.):	**12**	
Floor Area (S.F.):	**20300**	
Labor Type:	**Union**	
Basement Included:	**Yes**	
Data Release:	**Year 2011 Quarter 3**	Costs are derived from a building model with basic components.
Cost Per Square Foot:	**$196.63**	Scope differences and market conditions can cause costs to vary significantly.
Building Cost:	**$3,991,500**	

		% of Total	Cost Per S.F.	Cost
A Substructure		**9.00%**	**$17.66**	**$358,500**
A1010	**Standard Foundations**		**$3.55**	**$72,000**
	Strip footing, concrete, reinforced, load 11.1 KLF, soil bearing capacity 6 KSF, 12" deep x 24" wide			
	Spread footings, 3000 PSI concrete, load 100K, soil bearing capacity 6 KSF, 4' - 6" square x 15" deep			
A1030	**Slab on Grade**		**$4.31**	**$87,500**
	Slab on grade, 4" thick, non industrial, reinforced			
A2010	**Basement Excavation**		**$2.78**	**$56,500**
	Excavate and fill, 10,000 SF, 8' deep, sand, gravel, or common earth, on site storage			
A2020	**Basement Walls**		**$7.02**	**$142,500**
	Foundation wall, CIP, 12' wall height, pumped, .444 CY/LF, 21.59 PLF, 12" thick			
B Shell		**26.10%**	**$51.26**	**$1,040,500**
B1010	**Floor Construction**		**$23.33**	**$473,500**
	Cast-in-place concrete column, 12" square, tied, 200K load, 12' story height, 142 lbs/LF, 4000PSI			
	Flat slab, concrete, with drop panels, 6" slab/2.5" panel, 12" column, 15'x15' bay, 75 PSF superimposed load, 153 PSF total load			
	Floor, concrete, slab form, open web bar joist @ 2' OC, on W beam and column, 35'x35' bay, 41" deep, 125 PSF superimposed load, 173 PSF total load			
	Floor, concrete, slab form, open web bar joist @ 2' OC, on W beam			

	and column, 35'x35' bay, 41" deep, 125 PSF superimposed load, 173 PSF total load, for columns add				
	Fireproofing, gypsum board, fire rated, 2 layers, 1" thick, 8" steel column, 3 hour rating, 14 PLF				
B1020	**Roof Construction**			**$7.24**	**$147,000**
	Floor, steel joists, beams, 1.5" 22 ga metal deck, on columns, 25'x30' bay, 25" deep, 40 PSF superimposed load, 60 PSF total load				
B2010	**Exterior Walls**			**$8.62**	**$175,000**
	Brick wall, composite double wythe, standard face/CMU back-up, 8" thick, perlite core fill				
B2020	**Exterior Windows**			**$3.77**	**$76,500**
	Aluminum flush tube frame, for 1/4"glass,1-3/4"x4", 5'x6' opening, no intermediate horizontals				
	Glazing panel, plate glass, 1/4" thick, clear				
B2030	**Exterior Doors**			**$2.04**	**$41,500**
	Door, aluminum & glass, with transom, narrow stile, double door, hardware, 6'-0" x 10'-0" opening				
	Door, aluminum & glass, with transom, non-standard, hardware, 3'-0" x 10'-0" opening				
B3010	**Roof Coverings**			**$5.57**	**$113,000**
	Roofing, asphalt flood coat, gravel, base sheet, 3 plies 15# asphalt felt, mopped				
	Insulation, rigid, roof deck, composite with 2" EPS, 1" perlite				
	Roof edges, aluminum, duranodic, .050" thick, 6" face				
	Flashing, aluminum, no backing sides, .019"				
	Gravel stop, aluminum, extruded, 4", mill finish, .050" thick				
B3020	**Roof Openings**			**$0.69**	**$14,000**
	Skylight, plastic domes, insulated curbs, 30 SF to 65 SF, single glazing				
	Roof hatch, with curb, 1" fiberglass insulation, 2'-6" x 3'-0", galvanized steel, 165 lbs				
	Smoke hatch, unlabeled, galvanized, 2'-6" x 3', not incl hand winch operator				
C Interiors			**13.20%**	**$25.91**	**$526,000**
C1010	**Partitions**			**$8.33**	**$169,000**
	Concrere block (CMU) partition, light weight, hollow, 6" thick, no finish				
	Concrere block (CMU) partition, light weight, hollow, 8" thick, no finish				
C1020	**Interior Doors**			**$1.26**	**$25,500**
	Door, single leaf, kd steel frame, kalamein fire, commercial quality, 3'-0" x 7'-0" x 1-3/4"				
C1030	**Fittings**			**$0.05**	**$1,000**
	Lockers, steel, single tier, 5' to 6' high, per opening, minimum				
C3010	**Wall Finishes**			**$5.34**	**$108,500**
	2 coats paint on masonry with block filler				
	Painting, masonry or concrete, latex, brushwork, primer & 2 coats				

	Wall coatings, epoxy coatings, maximum				
C3020	**Floor Finishes**			**$5.05**	**$102,500**
	Carpet tile, nylon, fusion bonded, 18" x 18" or 24" x 24", 35 oz				
	Composition flooring, epoxy, minimum				
	Vinyl, composition tile, maximum				
C3030	**Ceiling Finishes**			**$5.89**	**$119,500**
	Acoustic ceilings, 3/4"mineral fiber, 12" x 12" tile, concealed 2" bar & channel grid, suspended support				
D Services			**46.70%**	**$91.85**	**$1,864,500**
D2010	**Plumbing Fixtures**			**$45.17**	**$917,000**
	Water closet, vitreous china, bowl only with flush valve, wall hung				
	Urinal, vitreous china, wall hung				
	Lavatory w/trim, wall hung, PE on CI, 18" x 15"				
	Lab sink w/trim, polyethylene, single bowl, double drainboard, 54" x 24" OD				
	Service sink w/trim, vitreous china, wall hung 22" x 20"				
	Shower, stall, fiberglass 1 piece, three walls, 36" square				
	Water cooler, electric, wall hung, wheelchair type, 7.5 GPH				
D2020	**Domestic Water Distribution**			**$5.49**	**$111,500**
	Gas fired water heater, commercial, 100< F rise, 600 MBH input, 576 GPH				
D2040	**Rain Water Drainage**			**$0.62**	**$12,500**
	Roof drain, CI, soil,single hub, 6" diam, 10' high				
	Roof drain, CI, soil,single hub, 6" diam, for each additional foot add				
D3050	**Terminal & Package Units**			**$17.93**	**$364,000**
	Rooftop, multizone, air conditioner, schools and colleges, 25,000 SF, 95.83 ton				
D4010	**Sprinklers**			**$2.61**	**$53,000**
	Wet pipe sprinkler systems, steel, light hazard, 1 floor, 50,000 SF				
D4020	**Standpipes**			**$0.25**	**$5,000**
	Wet standpipe risers, class III, steel, black, sch 40, 6" diam pipe, 1 floor				
D5010	**Electrical Service/Distribution**			**$4.56**	**$92,500**
	Service installation, includes breakers, metering, 20' conduit & wire, 3 phase, 4 wire, 120/208 V, 1000 A				
	Feeder installation 600 V, including RGS conduit and XHHW wire, 1000 A				
	Switchgear installation, incl switchboard, panels & circuit breaker, 1200 A				
D5020	**Lighting and Branch Wiring**			**$11.26**	**$228,500**
	Receptacles incl plate, box, conduit, wire, 8 per 1000 SF, .9 W per SF, with transformer				
	Wall switches, 2.0 per 1000 SF				
	Miscellaneous power, 1 watt				
	Central air conditioning power, 3 watts				

	Fluorescent fixtures recess mounted in ceiling, 1.6 watt per SF, 40 FC, 10 fixtures @32watt per 1000 SF				
D5030	**Communications and Security**			**$3.60**	**$73,000**
	Communication and alarm systems, fire detection, addressable, 50 detectors, includes outlets, boxes, conduit and wire				
	Fire alarm command center, addressable with voice, excl. wire & conduit				
	Internet wiring, 8 data/voice outlets per 1000 S.F.				
D5090	**Other Electrical Systems**			**$0.37**	**$7,500**
	Generator sets, w/battery, charger, muffler and transfer switch, gas/gasoline operated, 3 phase, 4 wire, 277/480 V, 11.5 kW				
	Uninterruptible power supply with standard battery pack, 15 kVA/12.75 kW				
E Equipment & Furnishings			**5.10%**	**$9.95**	**$202,000**
E1020	**Institutional Equipment**			**$1.60**	**$32,500**
	Architectural equipment, laboratory equipment glassware washer, distilled water, deluxe				
	Architectural equipment, laboratory equipment glove box, fiberglass, radio isotope				
	Architectural equipment, laboratory equipment, cabinets, wall, open				
	Architectural equipment, laboratory equipment, cabinets, base, drawer units				
	Architectural equipment, laboratory equipment fume hoods, not including HVAC, deluxe including fixtures				
E1090	**Other Equipment**			**$8.35**	**$169,500**
	4 - Laboratory equipment, safety equipment, deluge shower				
	5 - Laboratory equipment, fume hood, ductwork, maximum				
	450 - Laboratory Casework, counter tops, acid-proof, excl. base cabinets, maximum				
	27 - Laboratory Casework, wall cabinets, with doors, 12" x 31"				
	78 - Laboratory Casework, tall storage cabinets, with glazed doors, 7' high				
	38 - Laboratory Casework, cabinets, base, drawer units, metal				
F Special Construction			**0.00%**	**$0.00**	**$0**
G Building Sitework			**0.00%**	**$0.00**	**$0**
SubTotal			**100%**	**$196.63**	**$3,991,500**
Contractor Fees (General Conditions,Overhead,Profit)			**0.00%**	**$0.00**	**$0**
Architectural Fees			**0.00%**	**$0.00**	**$0**
User Fees			**0.00%**	**$0.00**	**$0**
Total Building Cost				**$196.63**	**$3,991,500**

MEP Systems

State Colle Pennsylvania 16801

Data Release :Year 2011 Quarter 3 **Assembly Cost Estimate**

Quantity	Assembly Number	Sourc	SubCo	Description	Unit	Material O&P	Installation O&P	Total O&P	Ext. Material O&P	Ext. Installation O&P	Ext. Total O&P	Labor Type	Data Release	Zip Code
				PLUMBING										
1	D20101102160			Water closet, vitreous china, bowl only with flush valve, floor mount, 18" high bowl, ADA compliant	Ea.	$ 788.58	$ 662.14	$ 1,450.72	$ 788.58	$ 662.14	$ 1,450.72	STD	Year 2011 Quarter 3	16801
1	D20102102000			Urinal, vitreous china, wall hung	Ea.	$ 596.49	$ 670.91	$ 1,267.40	$ 596.49	$ 670.91	$ 1,267.40	STD	Year 2011 Quarter 3	16801
14	D20103102040			Lavatory w/trim, wall hung, PE on CI, 18" x 15"	Ea.	$ 879.57	$ 657.75	$ 1,537.32	$ 12,313.98	$ 9,208.50	$ 21,522.48	STD	Year 2011 Quarter 3	16801
9	D20103101760			Lavatory w/trim, vanity top, stainless, self-rimming, 25" x 22"	Ea.	$ 758.25	$ 596.36	$ 1,354.61	$ 6,824.25	$ 5,367.24	$ 12,191.49	STD	Year 2011 Quarter 3	16801
2	D20104101920			Kitchen sink w/trim, countertop, stainless steel, 25" x 22" single bowl	Ea.	$ 1,112.10	$ 653.37	$ 1,765.47	$ 2,224.20	$ 1,306.74	$ 3,530.94	STD	Year 2011 Quarter 3	16801
2	D20107101920			Shower, stall, polypropylene, molded stone receptor, 32" square	Ea.	$ 955.40	$ 986.63	$ 1,942.03	$ 1,910.80	$ 1,973.26	$ 3,884.06	STD	Year 2011 Quarter 3	16801
2	D20104404260			Service sink w/trim, PE on CI, corner floor, 28" x 28", w/rim guard	Ea.	$ 2,097.83	$ 841.92	$ 2,939.75	$ 4,195.66	$ 1,683.84	$ 5,879.50	STD	Year 2011 Quarter 3	16801
1	D20108202000			Water cooler, electric, wall hung, full recessed, 8 GPH	Ea.	$ 2,224.20	$ 543.74	$ 2,767.94	$ 2,224.20	$ 543.74	$ 2,767.94	STD	Year 2011 Quarter 3	16801
2	D20202401820			Electric water heater, commercial, 100< F rise, 50 gallon tank, 9 KW 37 GPH	Ea.	$ 4,220.93	$ 964.70	$ 5,185.63	$ 8,441.86	$ 1,929.40	$ 10,371.26	STD	Year 2011 Quarter 3	16801
2	D20202401860			Electric water heater, commercial, 100< F rise, 80 gal, 12 KW 49 GPH	Ea.	$ 6,066.00	$ 1,205.88	$ 7,271.88	$ 12,132.00	$ 2,411.76	$ 14,543.76	STD	Year 2011 Quarter 3	16801
1	D20202402380			Electric water heater, commercial, 100< F rise, 1000 gal, 60 KW 245 GPH	Ea.	$ 33,059.70	$ 3,836.88	$ 36,896.58	$ 33,059.70	$ 3,836.88	$ 36,896.58	STD	Year 2011 Quarter 3	16801
	TOTAL										$ 114,306.13			
				FIRE PROTECTION										
5000	D40103101560			Dry pipe sprinkler systems, steel, extra hazard, 1 floor, 5000 SF	S.F.	$ 3.31	$ 2.99	$ 6.30	$ 16,550.00	$ 14,950.00	$ 31,500.00	STD	Year 2011 Quarter 3	16801
15000	D40103101720			Dry pipe sprinkler systems, steel, extra hazard, each additional floor, 5000 SF	S.F.	$ 2.31	$ 2.59	$ 4.90	$ 34,650.00	$ 38,850.00	$ 73,500.00	STD	Year 2011 Quarter 3	16801
1	D40203300580			Dry standpipe risers, class I, steel, black, sch 40, 6" diam pipe, 1 floor	Floor	$ 4,726.43	$ 3,865.38	$ 8,591.81	$ 4,726.43	$ 3,865.38	$ 8,591.81	STD	Year 2011 Quarter 3	16801
3	D40203300600			Dry standpipe risers, class I, steel, black, sch 40, 6" diam pipe, additional floors	Floor	$ 1,516.50	$ 1,307.88	$ 2,824.38	$ 4,549.50	$ 3,923.64	$ 8,473.14	STD	Year 2011 Quarter 3	16801
	TOTAL										$ 122,064.95			
				HVAC										
2	D30201301140			Boiler, cast iron, gas, hot water, 6970 MBH	Ea.	$ 119,298.00	$ 37,923.00	$ 157,221.00	$ 238,596.00	$ 75,846.00	$ 314,442.00	STD	Year 2011 Quarter 3	16801
4	D30401121020			AHU, central station, cool/heat coils, VAV, filters, 10,000 CFM	Ea.	$ 47,415.90	$ 10,264.20	$ 57,680.10	$ 189,663.60	$ 41,056.80	$ 230,720.40	STD	Year 2011 Quarter 3	16801
1	D30401101020			AHU, central station, cool/heat coils, constant volume, filters, 5,000 CFM	Ea.	$ 22,343.10	$ 7,213.33	$ 29,556.43	$ 22,343.10	$ 7,213.33	$ 29,556.43	STD	Year 2011 Quarter 3	16801
2	D30401361020			VAV terminal, cooling, fan powered, with actuator / controls, 400 CFM	Ea.	$ 1,617.60	$ 1,644.38	$ 3,261.98	$ 3,235.20	$ 3,288.76	$ 6,523.96	STD	Year 2011 Quarter 3	16801
1	D30401361040			VAV terminal, cooling, fan powered, with actuator / controls, 800 CFM	Ea.	$ 2,047.28	$ 3,135.28	$ 5,182.56	$ 2,047.28	$ 3,135.28	$ 5,182.56	STD	Year 2011 Quarter 3	16801
1	D30401361060			VAV terminal, cooling, fan powered, with actuator / controls, 1250 CFM	Ea.	$ 2,552.78	$ 4,757.73	$ 7,310.51	$ 2,552.78	$ 4,757.73	$ 7,310.51	STD	Year 2011 Quarter 3	16801
1	D30401361070			VAV terminal, cooling, fan powered, with actuator / controls, 1500 CFM	Ea.	$ 2,679.15	$ 5,568.95	$ 8,248.10	$ 2,679.15	$ 5,568.95	$ 8,248.10	STD	Year 2011 Quarter 3	16801
2	D30301301030			Chiller, reciprocating, water cooled, standard controls, 150 ton	Ea.	$ 77,847.00	$ 25,617.00	$ 103,464.00	$ 155,694.00	$ 51,234.00	$ 206,928.00	STD	Year 2011 Quarter 3	16801
5	D30903101010			Fume hood exhaust system, 3 FT long, 1000 CFM	Ea.	$ 13,446.30	$ 2,806.40	$ 16,252.70	$ 67,231.50	$ 14,032.00	$ 81,263.50	STD	Year 2011 Quarter 3	16801
	TOTAL										$ 890,175.46			
				ELECTRICAL										
23300	D50202080720			Fluorescent fixtures, type A, 41 fixtures per 3000 SF	S.F.	$ 2.20	$ 5.48	$ 7.68	$ 51,260.00	$ 127,684.00	$ 178,944.00	STD	Year 2011 Quarter 3	16801
187	D50201250520			Receptacle duplex 120 V grounded, 15 A with box, plate, 3/4" EMT & wire	Ea.	$ 41.37	$ 215.99	$ 257.36	$ 7,736.19	$ 40,390.13	$ 48,126.32	STD	Year 2011 Quarter 3	16801
55	D50201250600			Receptacle duplex G.F.I. 15 A with box, plate, 3/4" EMT & wire	Ea.	$ 79.71	$ 224.81	$ 304.52	$ 4,384.05	$ 12,364.55	$ 16,748.60	STD	Year 2011 Quarter 3	16801
0	D50102300480			Feeder installation 600 V, including RGS conduit and XHHW wire, 1200 A	L.F.	$ 228.03	$ 128.93	$ 356.96	$ -	$ -	$ 136,818.00	STD	Year 2011 Quarter 3	16801
2	D50101200480			Service installation, includes breakers, metering, 20' conduit & wire, 3 phase, 4 wire, 120/208 V, 1200 A	Ea.	$ 15,942.20	$ 6,612.00	$ 22,554.20	$ 31,884.40	$ 13,224.00	$ 45,108.40	STD	Year 2011 Quarter 3	16801
	TOTAL										$ 425,745.32			

[APPENDIX B-2]

RSMeans Costworks® 2011 Assemblies Estimate Report

[APPENDIX C]

OVERALL SITE PLAN AND EXISTING CONDITIONS

BIOLOGICAL RESEARCH LABORATORY
UNIVERSITY PARK, PA.

EXISTING CONDITIONS SITE PLAN

MICHAEL CARBONARA

SEPTEMBER 20, 2011

SYMBOLS	
CONSTRUCTION AREA	
BUILDINGS	
ASPHAULT	
GRASS	
GRAVEL ROAD	
TREES	
VEHICLE TRAFFIC	
CONSTRUCTION FENSE	

EXISTING UTILITIES	
RED LINE Sanitary Waste Line	
BLUE LINE Water Line	
PURPLE LINE Telecommunications	
YELLOW LINE Electrical Services	
YELLOW DIAMONDS Electrical Transformers	
RED SQUARES Fire hydrants	

[APPENDIX C-1]

OVERALL SITE PLAN AND EXCAVATION PLAN

BIOLOGICAL RESEARCH LABORATORY
UNIVERSITY PARK, PA.

EXCAVATION SITE PLAN

MICHAEL CARBONARA

SEPTEMBER 20, 2011

SYMBOLS	
CONSTRUCTION AREA	
BUILDINGS	
ASPHAULT	
GRASS	
GRAVEL ROAD	
TREES	
VEHICLE TRAFFIC	
CONSTRUCTION FENSE	
EXCAVATION PHASE	
Temp Utilities to Trailer	
Excavator	
Dumptruck	
Bull Dozer	
Material Storage trailers	
Portable Toilet	
RED—Fire hydrants Yellow – Transformers	

[APPENDIX C-2]

OVERALL SITE PLAN AND SUPERSTRUCTURE PLAN

BIOLOGICAL RESEARCH LABORATORY
UNIVERSITY PARK, PA.

SUPERSTRUCTURE SITE PLAN

MICHAEL CARBONARA

SEPTEMBER 20, 2011

SYMBOLS	
CONSTRUCTION AREA	
BUILDINGS	
ASPHAULT	
GRASS	
GRAVEL ROAD	
TREES	
VEHICLE TRAFFIC	
CONSTRUCTION FENSE	

EXCAVATION PHASE	
Temp Utilities to Trailer	
Crane	
Dumpsters	
Bull Dozer	
Material Storage trailers	
Portable Toilet	
RED—Fire hydrants Yellow – Transformers	

[APPENDIX C-3]

OVERALL SITE PLAN AND FINISHES PLAN

BIOLOGICAL RESEARCH LABORATORY
UNIVERSITY PARK, PA.

FINISHES SITE PLAN

MICHAEL CARBONARA

SEPTEMBER 20, 2011

SYMBOLS	
CONSTRUCTION AREA	
BUILDINGS	
ASPHAULT	
GRASS	
CONCRETE PAD/ WALKWAYS	
GRAVEL ROAD	
TREES	
VEHICLE TRAFFIC	
CONSTRUCTION FENSE	

FINISHES PHASE	
Temp Utilities to Trailer	
Concrete Trucks	
Dumpsters	
Bull Dozer	
Material Storage trailers	
Portable Toilet	
RED—Fire hydrants Yellow – Transformers	