Ghana Clean Water Initiative – Risk Management

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In August of 2019 several Cal Poly Students will be traveling to a remote fishing village located off of Lake Volta in Ghana. This project is being completed by Cal Polys MCAA chapter alongside the NECA chapter. These students will be constructing a community center, a water filtration system, and ice making and refrigeration facilities. The project will rely heavily on solar power as there is no grid in the village the project is taking place in. This project inherently has many risks associated with it and needs a risk management plan to combat these risks. The three ways these risks will be handled are through acceptance, mitigation, and transfer. The following information is directly related to MCAAs scope items which is the water filtration and pumping system.

Keywords: Risk Management, Mechanical, Developing Country, Water Filtration, Remote Location

Introduction

Any construction project has risks involved, whether it be budget, safety, schedule constraints, or labor shortages. Risk is an inevitable fact of the construction industry and proper action should be taken to minimize exposure to risk. When a project takes place in a remote area in a developing country these risks can be greatly elevated. By analyzed the risks involved with a project they can become prioritized and mitigated properly. The three ways to deal with risks are accept, mitigate, transfer. This project due to the self-perform and single team aspects will primarily use acceptance and mitigation techniques to handle the associated risks.

Project Risks

This project has many risks that are common within the construction industry as well as several unique risks due to the remote location of the project.

<table>
<thead>
<tr>
<th>Risk Topic</th>
<th>Description</th>
<th>Project Specific Risk</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contracting Disease</td>
<td>This project has an extremely high risk of contracting disease. The CDC recommends several different vaccinations while traveling in Ghana. Due to the extended period of time in the country, the remote location, as well as relying on local food for the trip the project team is at a heightened risk for these diseases.</td>
<td>If a team member were to contract a disease while on site, they could be sent home. There is high risk at dusk and dawn to contract disease due to the presence of mosquitoes.</td>
</tr>
<tr>
<td>Shipping, Export, and Import</td>
<td>Due to this project being located in a different country items will have to be shipped. If there are any issues with import agencies the project will be severely delayed. Import duties are approximately 50% of claimed value.</td>
<td>The shipment could get held up in international customs.</td>
</tr>
<tr>
<td>Theft</td>
<td>Theft is highly probable. Many items have large value and can be easily resold.</td>
<td>The theft of a critical, non-replaceable item, such as the pump or marine grade wire.</td>
</tr>
</tbody>
</table>
Local Culture  
This project is located in a region that has very different local customs and traditions compared to America. The region also has very deep-rooted expectations to adhere to these customs.  
Getting different tribes to work together on the project, as well as risk of being barred from doing the project.

Incomplete Design  
The pumping system is critical to the function and performance of the other systems. Without a complete or effective design, the project will be a failure.  
Components of the system not being compatible with one another.

Going Over Budget  
If the project does not have enough funding it will be incomplete and not work properly.  
Not having enough money to procure items while abroad.

Jobsite Safety  
As with any project jobsite safety is of upmost importance. Personal safety can have a huge effect on the project schedule as well as long lasting effects on individuals.  
Performing hazardous activities, using power tools and obtaining a personal injury.

Tight Schedule  
The team will only be in the country for 20 days. This is a short amount of time for procurement, installation and testing.  
Not completing the project.

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**Risk – Management**

Due to the inherent risks with this project a proper management plan needs to be in place to address these risks.

<table>
<thead>
<tr>
<th>Risk Topic</th>
<th>Management Type</th>
<th>Management Process</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contracting Disease</td>
<td>Mitigation</td>
<td>Ensure team has received all vaccinations prior to departure. Refer to Center for Disease Controls website for necessary vaccinations.</td>
</tr>
<tr>
<td>Shipping, Export, and Import</td>
<td>Acceptance, Mitigation</td>
<td>Procure items in Ghana, this will limit import duties, as well as prevent delays. Ship un-essential tools and materials that can arrive late.</td>
</tr>
<tr>
<td>Theft</td>
<td>Acceptance, Mitigation</td>
<td>Ensure central location in village for expensive/valuable items. Locate pump far offshore and fully submerged. Bury electric conductors as to not make visible.</td>
</tr>
<tr>
<td>Local Culture</td>
<td>Acceptance, Mitigation</td>
<td>Have Dr. Heston go over customs and traditions with team. Perform research on what to expect from locals.</td>
</tr>
<tr>
<td>Incomplete Design</td>
<td>Acceptance, Mitigation</td>
<td>Review all specifications for equipment and materials and ensure compatibility. Have competent person review design to ensure system feasibility. Consult experienced personnel that have dealt with similar systems</td>
</tr>
<tr>
<td>Going Over Budget</td>
<td>Mitigation</td>
<td>Ensure budget is well above estimate. While transferring funds to local currency utilize best exchange rate and lowest transfer cost. Purchase materials locally; these will have lower cost than in U.S.A as well as no import duty.</td>
</tr>
<tr>
<td>Tight Schedule</td>
<td>Mitigation</td>
<td>Ensure plenty of time on jobsite to perform required tasks. Utilize local labor to help with construction.</td>
</tr>
</tbody>
</table>
Additional Risks

This project will present many challenges, both known and unknown. By lessening the impact of the known risks, the project will have a much higher likelihood of success. The project team still needs to prepare for any unknown risks that may present itself during the project. Throughout the course of this project I have had to think of many different issues that can arise during the construction process. Some long-term risks have come from the design and how the system may not perform as intended.

This design of the pump used in this project creates a long-term risk to the villagers. Due to the high pressures this pump can create, long run of tubing, lower pressure rated tubing, and extreme conditions of the project site there is a heightened risk of bursting the line. If the line were to burst E.G. someone digging and rupturing it, or tubing beaming clogged., serious harm could occur to nearby people. Due to this issue there had to be a pressure relief valve in order to relieve the system if pressure were to get to a dangerous level. This impacted other risks such as budget and jobsite safety.

Process

For this project I relied heavily on past experiences in classes as well as jobsite experience. From my education I was able to recognize risks that occur on many jobsites and see if they would be applicable to this project. My experience in working on large commercial projects lead me to create the Activity Hazard Analysis Form that will be utilized on this project (see appendix B). For information pertaining to local customs and traditions I relied on information provided from Nathan Heston (see appendix C). Heston is one of the leads on this project, and has extensive experience building in this village and region. For information pertaining to disease I utilized information provided from the Center for Disease Control (see appendix D). Information about disease and practices used to minimize possibility of contracting one I also utilized information provided by Heston, and my advisor Paul Weber, who has had extensive experience working in remote locations around the world. My scores for probability and impact that were created in the risk mitigation chart (see appendix A) were created on a 1-10 scale, as I deemed appropriate, then multiplied to create the overall risk score. The post-mitigation score was created by analyzing the probability and impact scores again once a plan was in place and multiplying those scores.

Conclusion

Construction is a very risky undertaking no matter the project size, complexity, budget, or duration. Many factors come into play and can easily snowball and create heightened risk for other aspects of the project. Proper techniques need to be used in order to make the project go as planned safely, efficiently, and on/under budget. Having a proper plan in place is vital to minimizing the risks associated with a particular jobsite as well as to reach expected goals. This project was diverse and presented one-off issues that do not typically have to be dealt with while building domestically. Some of these included the shipping of materials and tools, restricted schedules, and vaccinations. One vaccination could have prevented the project from happening at all. The yellow fever vaccine is in extremely limited supply in the United States and if not administered one can be denied of entering the country at all. This project presented many challenges and complexities but with proper risk management techniques the project should be a success and provide the village of Agbokpa, Ghana with clean water, ice making and refrigeration abilities, and a community center all powered by solar.

Appendix – Risk Mitigation & AHA Form
Appendix A

<table>
<thead>
<tr>
<th>Risk</th>
<th>Probability (1-10)</th>
<th>Impact (1-10)</th>
<th>Risk Score (1-100)</th>
<th>Mitigation</th>
<th>Risk Score After Mitigation (1-100)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Disease</td>
<td>8</td>
<td>10</td>
<td>80</td>
<td>Ensure team has received all vaccinations prior to departure. Refer to Center for Disease Control website for necessary vaccinations.</td>
<td>33</td>
</tr>
<tr>
<td>Shipping &amp; Import</td>
<td>8</td>
<td>10</td>
<td>80</td>
<td>Procure items in Ghana; this will limit import duties, as well as prevent delays. Ship unessential tools and materials that can arrive late.</td>
<td>30</td>
</tr>
<tr>
<td>Theft</td>
<td>7</td>
<td>9</td>
<td>63</td>
<td>Ensure central location in village for expensive/valuable items. Locate pump for offshore and fully submerged. Bury electric conductors as to not make visible.</td>
<td>50</td>
</tr>
<tr>
<td>Local Culture</td>
<td>6</td>
<td>2</td>
<td>12</td>
<td>Have Dr. Hesson go over customs and traditions with team. Perform research on what to expect from locals.</td>
<td>5</td>
</tr>
<tr>
<td>Incomplete Design</td>
<td>6</td>
<td>10</td>
<td>60</td>
<td>Review all specifications for equipment and materials and ensure compatibility. Have competent person review design to ensure system feasibility. Consult experienced personnel that have dealt with similar systems.</td>
<td>35</td>
</tr>
<tr>
<td>Going Over Budget</td>
<td>5</td>
<td>10</td>
<td>50</td>
<td>Ensure budget is well above estimate. While transferring funds to local currency utilize best exchange rate and lowest transfer cost. Purchase materials locally; these will have lower cost than in U.S.A as well as no import duty.</td>
<td>30</td>
</tr>
<tr>
<td>Jobsite Safety</td>
<td>7</td>
<td>9</td>
<td>63</td>
<td>Utilize Job Hazard Analysis forms. Review proper construction methods before performing a task. Utilize proper PPE. Supervise local workers and advise/prohibit dangerous tasks.</td>
<td>20</td>
</tr>
<tr>
<td>Tight Schedule</td>
<td>5</td>
<td>8</td>
<td>40</td>
<td>Ensure plenty of time on jobsite to perform required tasks. Utilize local labor to help with construction.</td>
<td>25</td>
</tr>
</tbody>
</table>

* Low score means limited risk

Appendix B

Activity Hazard Analysis

Who's Performing Work:

Tool List:

<table>
<thead>
<tr>
<th>Likelihood</th>
<th>Probability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Severity</td>
<td>Likelihood</td>
</tr>
<tr>
<td>Catastrophic</td>
<td>E</td>
</tr>
<tr>
<td>Marginal</td>
<td>M</td>
</tr>
<tr>
<td>Negligible</td>
<td>L</td>
</tr>
</tbody>
</table>

Task | Hazards | Prevention

Signatures:

Supervisor:

- Extremely High Risk
- High Risk
- Moderate Risk
- Low Risk
Appendix C

Notes for the 2019 Ghana Project Travel Team

Nathan Heston last updated June 12, 2019. These are items that I have though of that I think will be helpful to you.

Here is a link to the state department’s travel recommendations for Ghana. Please visit this site to review the recommendations prior to departure.


**Clothing:**

I encourage you to consider long sleeve clothing for sun and mosquito protection. Quick dry clothing is nice to have especially during the rainy season when clothing takes a long time to dry.

**Etiquette:**

In Ghanaian culture, it is the person who is approaching who is expected to provide a greeting. This can be as simple as a nod and a smile. Often it is a handshake. When shaking hands always use your right hand. Use of the left hand is considered rude in traditional culture to do things such as hand items to people greet, etc. You’ll get a pass since you’re a foreigner, but it is nice to know. When greeting a large group greeting is traditionally done from your right counterclockwise to your left. Ghanaians are very friendly and man people will often greet you and offer to help carry items etc. It is okay to let them help though I wouldn’t do this at the airport. It is rude for a young person not to help an elder carrying things, so don’t be offended if a youth insists on carrying your items. It is not a statement about their perception of your abilities.

**Medical/Daily Considerations:**

Mosquitos are mostly only active dusk to dawn. For mosquito protection I encourage you to bring bug spray. It is hard to find sunlotion in Ghana. I encourage you to bring enough for yourself. Similarly this is the case with Shampoo. While traveling in developed countries it is a good idea to brush your teeth with filtered water. This is readily available almost everywhere in Ghana. Most medicines are available at Ghanaian pharmacies. I encourage you to consult with your doctor about taking a malaria prophylaxis like mefloquine. I do not, but I always carry the antimalarial drug coartem with me.

**Entering Ghana at the airport**

When you arrive in Ghana you will have to come through immigration first and then customs. Often there are agents checking your vaccination cards for your yellow fever vaccination just prior to the immigration checkpoints. Have your proof of yellow fever available. If you don’t
have it they might make you pay a “$20 fine”. Smiling, being nice, and not having cash could help you avoid this if you don’t have the vaccination.

Immigration will check your passports for your tourist visas. This is generally quick and easy. Sometimes they will hassle you for an address where you are staying. You can use the address I provided for your Visas:

a. Name of Hotel/Guest House in Ghana: **Jlw Hostel**
b. Street (Mailing address): 1 University Avenue
c. City/Town: **Berekuso**
d. Region: **Eastern**
e. Telephone Number: **+233 55 301 6051**

Just make sure that you don’t give the impression that you are there to make money. You will be volunteering/touring sites in Ghana. Once you pass through immigration you will arrive at customs. You should be given a customs card to fill out on the plane. They want to make sure you aren’t bringing things in to sell. I have only been searched once on my approximately 10 entries to Ghana. Once passing bye customs (sometimes there isn’t even an agent there) you will proceed down a walkway and come out into surprisingly warm air where many people are waiting for arrivals. There are ATMs here and taxi drivers looking to overcharge you☺. We will be there to meet you just outside the waiting area.

**Communication:**

Prior to departure our group will communicate via email and with a WhatsApp Group messaging service. To help family and friends stay aware of our groups progress and well-being, I am advocating that we maintain a group blog that we update weekly prior to the trip and frequently(daily?) during the project.

Volunteer to set this up?

When in Ghana each of you will have a local phone number (to be purchased there). I recommend that you do not purchase an international calling plan from an American Company as these typically are expensive and don’t work well abroad in my past experience. I will purchase sim cards for you in Ghana once I arrive and we will fill out the Contact List(at the end of this section) which I would like for you to carry with you when traveling. Can you please each send me a copy of your passport to help me do this.

Once in Ghana, WhatsApp will be a valuable resource for group communication. I encourage to download this app to your phone if you don’t already have it. we will primarily use the WhatsApp messaging service, local phone numbers, and

1. **Calling Ghana from the USA:**
To make an international phone call you must dial a “+” and the country code. For Ghana the country code is +233. It is expensive to call Ghana from the US (typically ~$1.00 / min). Most people either make voice calls using WhatsApp which needs a good internet connection on both ends, or use a subscription service to call cellular phone numbers. If you need to be calling phone numbers in Ghana I encourage you to download an App called Boss Revolution. The cost to call Ghana is then ~$0.20 per minute.

2. Calling the USA from Ghana:

If digital communication isn’t sufficient you can call landlines in the USA from Ghana. This is relatively cheap (~$0.10) to call the USA from Ghana.

2. Accommodations in Agbokpa

In the village of Agbokpa our accommodations will not be what you are accustomed to. We will have rental mattresses that will be arranged on a cement floor in the chief’s house. Please bring sheets or a light sleeping bag to sleep in. We will be hiring a cook to prepare food for us while in the village. There will be a charge of $8/day each for three meals/day. The chief has a pit latrine which we will use. Washing our hands and brushing our teeth will be done using filtered water.

Mapping Information

The village of Agbokpa is accessed by a 30 minute boat ride across Lake Volta from the town of Kotoso. The town of Kotoso has about 5000 residents and is the site of the nearest government health clinic. Though not shown on this map, there is a good paved road leads about 5 miles from the town of Kotoso to Kwahu Tafo where a small Government Hospital and Maternity Clinic is. The nearest regional hospital (Atibea Regional Hospital) is about 15-20 miles from the site located in the town of Mpraeso.

Other hospitals exist in the city of Nkawkaw and a personal friend of Dr. Heston’s, Dr. Genevieve Insaidoo, is a physician at Holy Family Hospital in Nkawkaw. She will be a consultant for the group during this trip.