

## Appendix F.1 John Lamm, TPQ Market Team Lead, Interview Minutes

Hello, we are Jacob, Osa, and Lorenzo. We are students in our Junior year at Worcester Polytechnic Institute. We are investigating solutions to the problem of excessive waste generated by the packaging of humanitarian goods. To do this, we have been gathering information on disaster area waste management systems. If you are willing, we would like to ask you a few questions about your experiences on the ground at disaster sites and allow you to express any opinions you may have. This interview should take about 45 minutes. Please inform us if you wish to remain anonymous. If you do not mind, we would like to quote this interview. You can also refuse to answer any question or let us know if you wish to stop the interview.

Lamm: That sounds good!

1. Can you elaborate on the role of TPQ (Technical Program Quality) Market Teams during a disaster response at some of the sites you have worked at?

First, I would say TQP is new, this version of our team has existed since June, we have been redefining it. Within our purview we are advisors, we do not manage the programs, but we go out to support teams and make recommendations. We have 3 sectors, 1 for reporting and helping people establish new livelihoods, help them transition back. Financial services, village loans at a community level. We work through temp employment, short term work contracts. Help rehab of community assets, that is comes from this. We have multiple purpose cash assistance; the multipurpose cash assistance is intended to cover a range of needs over a large amount of sectors. It covers monthly needs; a food basket or what people need for hygiene can have a stipend for that or transport. But for this we are trying to meet a range of basic needs compared to things that would be sectoral. This basket of goods for CPI in the US, we track inflation, and we price them out and that is how we do money in emergencies. Food assistance is under TPQ, our advisors have covered this. This is a large in scope, half of the funds we will implement from BHA. We cover technical areas, we do not manage them, but we make recommendations and cluster. We coordinate with them and working groups on the ground and what to implement. I spent 5 years as a backstop officer, I organized programs, I worked on Hurricane Matthew Haiti, Dorian in Bahamas, South Sudan twice, Iraq, Venezuela response from a regional point of view.

**Commented [CJ1]:** Advisors: Word Document is provided for any comments. The PDF version will be submitted.

**Commented [HJP2R1]:** When you use acronyms, explain their meaning the first time you use them. For example, what does TPQ stand for? Does WASH mean what I think it means, or does it stand for something else?

That is, in terms of DART deployment, I do 1 a year for 6-7 weeks, other people vary, many of our technical advisors will do less but do more short-term assessments. Some of them are rapid onset, it could be a large percentage of our programs are ongoing and that is where most of the funding goes.

2. We are very interested in the role of DART, to our understanding they help coordinate the response of USAID and other organizations, but this can differ from disaster to disaster. Can you tell us about the impact of DART and its operations at the sites you have worked at?

It does depend on nature of the disaster when rapid onset is search and rescue. Next will be assessment teams, after that will be setup for architecture for response. Telecoms, some will go and setup Wi-Fi and locations. Satellite. That is the very early part of responses, people like me do not go out that early, I have been out as early of 7 days. S&R are the true rapid onset. I got there once at the camping phase and this is a minority of our programs, this does happen where we set up a base camp working out of tents. Immediate response to help people saving lives who are in immediate danger. Food assistance takes time to arrive we look at what could be done in theatre but a lot of times we need to bring in stuff from outside. Prepositioned food it can be days or weeks before it arrives and if it is not, we must go through procurement, and it takes longer. In the US, it is an even longer timeline, with regional and local it also takes a fair amount of time. We normally have a warehouse where we can bring things in. if it is a Hurricane or earthquake, we use an MRE. We do that usually the next thing for us is assessments and response plan whether we can use things from local markets, can we rely on things that people can buy where they live, if not we have to buy them from outside. Also, how will they use it. We have needs assessment stage and how we can address those and then implementing it. Broad that is what DART is doing while feeding info back to Washington, the ground must continue the info they supply to get the resources they need.

3. For our project we investigate the waste left by Humanitarian Organizations at disaster sites. What kinds of waste were most common at the sites that you worked at? What can you tell us about the waste management systems? What materials

generated the most waste? What were/are the most troublesome or difficult forms of waste?

It would be difficult for what is troublesome or not. To run through obvious culprits, we must bring stuff in and it's packaged in a way for household distribution, more plastic involved there. Certainly, nutrition products are individually wrapped, bars, pastes, in the box we have 8 servings a day for children. 8 unwrapped things in a box that a fair amount of waste. For commodities are brought in bulk, bags are used until there are too many holes in them. Woven 40-60 kilo bags. The metal jerry cans get used a lot; I have some that have USAID logo because we made them out of cans. I have seen doors made out of them, art, we do see the metal used quite a lot in different contexts. Tarps are typically used for storm damage and initially they will be used to batten down houses, but it will eventually get replaced, we want people to replace them, so they have houses so they are not humanitarian relief tarps over them. Sometimes you come back and still see that, but if the person worked the way it did, they are in the environment. These are very big plastic pieces. NFI are distributed that are monthly recurring items you are going to end up with a fair amount of waste. I do not know all the details with biodegradability but sheer volumes it is the food items, hygiene items that are every month. You will end up with a lot of that every month, those are the obvi. After immediate that transitions away. You have a lot of bags of stuff, toothpaste, soap, women's hygiene products and you are giving them out to everyone. They are designed to be modular they do not align to household size either, you will have some that are not enough or some that are more than enough, more waste there if it is not designed for household size. I am getting things I cannot not use.

4. Are you aware of any attempts to limit the buildup of this waste during the Rapid Onset Portion of Disaster Response at any of the sites you have worked at? What were the results?

There has not been a lot, there has been talk about it. The grand challenge it did not happen, they did not want to get down to that level. Within that framework there are awards, beyond just having four broad categories you can have a specific one. Not just what you have in energy or agriculture, but we have a thing we want you to fix. Factoring Ebola in, this seamstress came up with the suits we thought it might be a good idea to put this challenge forth and see what private

sector academia have come up with. Did not go because the direction was not there. Other than that, I am familiar with WFP innovation accelerator, with the work in Camp settings, Bangladesh. Looked at camp waste, creating a local solution for waste disposal. There might have been another, it has come from WFP accelerator I have no info that have done it for Rapid onset. Types of waste will not be dissimilar, if we can adapt rapid onset to that would be good. More so we have been talked about but have not seen a whole lot done, who does this sit with. This supply chain division, none of us advisors had budget dedicated. As a market guy I am interested but I am not a professional, that may attribute to the progress of this.

5. Can you give us an idea of how waste was being processed at some of the sites that you have worked at?

I wish I could. In a rapid onset, not being cynical. It winds up in the street, on the curb. You are distributing, when you do have something like this the site might be a church or someone's business, could be a government building but you have a staging area and give it out and these people go back to their homes. If they are not in a settlement there is not a humanitarian settlement, if they are displaced and congregating in one location, if that did not happen, which it often does not, they tend to go back to where they live. As soon as they have the tarps back, they go back to prevent the looting. Dorian in Bahamas, once we got the initial stuff, we were driving around to find people to give it out, early on we try to give this info out, but people are not consuming at distribution sites. For refugees' emergencies you might have soup kitchens. If sanitation services are not up it goes in the street and gutters, this is why we are concerned with it. These govt services are not there then it is up to the communities to focus on this, in some it was bad before.

6. Did you have any experience where you felt the cultural practices of the local populations inhibited or promoted waste management?

Wide range, in some countries there is a culture tidier than others. In places I have been, outside of rapid deployment that the streets are always dirty, not necessarily strong govt systems. If there is paid sanitation, cleanup they sometimes do not get paid on time, it might not be there. Some there is more of a unionized effort, they have arrangements for the youth to get paid to keep neighborhood clean. Completely cultural.

7. From disaster sites you have worked at or are knowledgeable about, are there any environmental factors that may provide increased challenges to waste management?  
What forms of waste provide the greatest danger of environmental harm?

I could speculate, in terms of other environmental factors, areas prone to flooding I would have more problems, more stuffs that would wind up getting washed into local water supply quickly. More of a concern I would think, if I had to guess there are areas where here are shallow water tables that would be of concern. Bangladesh is low with saline, pretty at-risk environment. In other places were people get displaced like pristine land and then, specifically in Bangladesh in Coxis... no longer Rapid, it is not a waste thing but the sheer numbers. They cause damage to local ecology but by sheer #s there was a crazy amount coming from a concentrated area, that was a rare event. If you wanted to extrapolate, when people are displaced and the only place that you can put them is already environmentally susceptible.

8. Do you have any experiences where reuse of packaging materials may be beneficial to a local economy? Are you aware of any attempts to repurpose waste to benefit response efforts?

It is used for a lot of art, something that is for sale and turn it into. A lot of times it is more likely they are not spending money on stuff. If used for construction or tools. For the bags, it is basically reused over and over again, using that bag over another one. If they are high quality, they get reused over and over again which helps the local economy. I do not know about say the fancier bags we have, the traditional woven ones I have seen, we also do not know if they are being resold. Are those ours or from a few years ago. We do see stuff and well we know they are reusing it but not marking it out. In terms of other, idk for certain if it seen in other sectors, tarps for sure but idk the profitable uses. A negative one they use malaria nets for fishing.

9. In other parts of the world recycling is not commonplace, how did local attitudes towards recycling and waste management affect waste management efforts at some of the sites you have worked at?

I would say that in a lot of places we work there is not a strong sentiment about recycling. The reusing they do. With plastic veggie oil they reuse, when distributing to break it up to use partial containers and pass it out. A lot but not everywhere, in Sub Saharan Africa most do not have strong recycling behavior. How would we if we wanted to, it is limited. It does impact the uptake on that, if it is not understood then it will not be as intuitive where people are accustomed to it if given the opportunities.

10. Within your department what changes could be made to be more environmentally sustainable? Within your agency or similar agencies, you are familiar with what changes might be introduced to be more environmentally sustainable? Do you see increased environmental awareness in your agency in terms of waste generated during relief efforts?

We do try to promote local procurement and cash vouchers when possible. It would limit the waste when possible so they can manage it locally. When they are buying food for when it is packaged. If we are working in Caribbean they go to supermarkets. In general, the way food is sold is in stalls and that has reduced packaging, it is not our first priority it is driven by the people's preference and if it is viable. The more we can do of that is less of the packaging we contribute, if they are going to stalls, they are bringing their own containers. That is within our interests, for the humanitarian waste the obvious thing is how we are packaging the preset kits. In prepositioned warehouses and how to buy things from US providers that is when we can look at it when setting it up systematically. When moving fast we cannot discuss this, takes time to repackaged and people are going hungry. I think that is what comes to mind from, me, the prepositioning but the specs in general for other things, kind of jerry cans we use. Where we buy in local communities it reduces that.

11. Thank you very much for your time. We appreciate your help on our project. Is there anything that has come to mind during this interview not addressed in earlier questions? Is there anyone else that you feel it would be beneficial for us to talk to?

Pre interview:

Greg: The big event we are working towards, the scoping consultations with all the different stakeholders, it led to enhanced coordination. That was the workshop this week, ended up 15 different orgs. From policy procurement to distribution, our goal is to make precedence on packaging and other areas with regards to supply chain management. LL solar recycling unit and pushing that forward, working at Villanova looking at life cycle expectancies. Taking into account use afterwards.

Lamm: That was interesting, I have been invested this for a while. I talked to this about Grand Challenges, did not come to fruition there but glad it has through different channels. I will share what I can.

This was at one point whether we could do more specific, after 1<sup>st</sup> round of grand challenge, there was concern the types of applications that we needed, specifics and we did not use them because they did not go to narrow challenges. Martha (Marissa?) Blublonski and I talked about this, this project what if we could come up solutions to waste management in rapid onset disasters. This is something that we had been talking about way back then.

Plastic bricks:

Livelihoods how long are people going to be involved. Timeline for the rapid response. Time and training for this and farmers can go back to farming next year they might want to go back to it. Training to do something new and have a short time when its profitable, does sound of WFP projects and makes a lot of sense in an informal/formal settlement. For people who cannot own land or farmland, they are prohibited things to do, this would be something they would be allowed to do. They do not need facilities or property to do, fits well for those contexts. For something that is short, and one off does not make sense to create a new livelihood unless we think there would be a demand for. If we could theoretically repurpose this as a post disaster sustainable livelihood, but do people recycle

to begin with. Is this long term especially with people where the humanitarian response is and not in their own homes than that would be more effective?

Difference with Rural Areas:

Nature response is different between the two, you see less of people coming to together. It is harder to identify them, in cities it is hard to see how is affected and who is not. So many of our systems especially for food is better for going out and seeing what areas are flooded and then go help them. What structures have collapses. In urban it is hard to see who is affected and how much, we see stuff that is more service delivery or more cash based where people come to you. On the food side they come to you when they need it vs you come get the sack of food and prepare it at home. See some differences like that and how it affects waste, in cities it is more likely we have a community to manage waste. In some bigger cities we have management by the community because it is lacking on a local level.

For temporary employment what we try to avoid is displacing established systems, i.e., waste cleanup. We have tried to be conscious to not paying people to do this and then everyone waits and lets waste accumulate and pick it up. Some disasters this has happened. Places where they know the humanitarians come in and pay people and putting it off than cleaning on a daily basis. We know that some do that and there is a risk of undermining systems that were previously in place.

People to talk to: I wonder if it would be useful for the hygiene type NFI for what waste has been associated with those. That is the big one that comes to mind. A lot of stuff that's put out and a lot of small plastics, that would stand out to me.

## **Appendix F.2 Tracy Wise & Frank Broadhurst, WASH Team Lead & WASH Advisor, Interview Minutes**

Hello, we are Jacob, Osa, and Lorenzo. We are students in our Junior year at Worcester Polytechnic Institute. We are investigating solutions to the problem of excessive waste generated by the packaging of humanitarian goods. To do this, we have been gathering information on disaster area waste management systems. If you are willing, we would like to ask you a few questions about DART emergency response and NGO's Response. This interview should take about 45 minutes. Please inform us if you wish to remain anonymous. If you do not mind, we would like to quote this interview. You can also refuse to answer any question or let us know if you wish to stop the interview.

Tracey: All sounds good for me I will see if Frank has any questions.

Frank: All good with the disclosures.

1. Introductions

- a. Ms. Wise, we understand that you are the Acting WASH Team Lead. Can you tell us about your time working there and your role in disaster response?

Tracy: We are a donor and do not have much initiative on packaging for WASH materials. A lot of what we are talking about today will potentially draw back more on our experiences on NGOs and what that means for DART and USAID. Besides sitting on at DHA as WASH advisors' initial sectors that need support is in fact WASH. We support that response in a variety of ways, we can be called upon by DART, can be deployed to disaster area and support their work through assessments, meeting with partners meeting local authorities. I can let Frank speak to that on more detail. When not deployed we provide similar support via remote assistance. Current hurricanes our WASH advisors have talked to regional advisors for what activities will be prioritized and how to go about those things. Reviewing concept notes and working with field staff, types of questions need to be asked, engage in WAASH cluster to weigh in on what they are putting forward, so we know our priorities are reflected. A lot of DARTS and RMTs that are not so sudden, they have been ongoing for multiple years. Tends to be at a slower pace, more time to develop a stronger strategy to the current context. Encourage more local use of materials, would not be advocating hygiene kits to be flown in. Very similar to assess strategy, how our partners are participating and influencing the response.

- b. Mr. Broadhurst, as a WASH Advisor, can you tell us a little about your role when a disaster strike?

Frank: Covered it well, when we have an on the ground DART our main role is that we are there to make sure that the funding BHA is providing for WASH is going towards clearly identified needs and is employed based on the best efforts we have. If we were responding to an area, like a cholera outbreak that is rapid onset, or a hurricane. We wanted to make sure any money we are spending and ventures through our partners are going to these problems and are they addressing the needs to prevent the cholera outbreak. Will not be spending money on household latrines, will focus on the things that will most likely prevent cholera, drinking water and hygiene behaviors. On the ground trying to understand what the situation is, talking to partners, cluster, other world agencies. Telegraph this info as best as possible for what they are interested in funding, not our focus, BHA or USAID or the US, we try to support the overall cluster and the US and INGO. Not completely in sync and we have different areas of focus, but we try to look at those items that are stressed within the humanitarian response plan. When we have the funding best as possible then it is trouble shooting and monitoring these activities and how they are going on. Some of these situations last years and years.

2. Can you tell us about the processes involved with deploying WASH Kits?

Frank: We understand that you send kits for water purification. Where do you think the majority of waste is generated from WASH kits? Wise: I would note we do not do a lot of kits for water purification, there might be things such as aqua tabs, we employ the hygiene kits primarily. The vast majority of waste particularly waste for agencies to control is the pallets and the boxes in which those items are shipped. We need to get them there and need to be in sturdy enough packaging. Other waste would be the wrappers, individual bars are in a paper substance, or multiple bars in a plastic bag. Likewise, for laundry detergent. Those are distributed to beneficiaries, how we reduce waste is by recommending that the items are put in buckets so that they do not need another bag or buckets. Put them inside the water buckets they are receiving in conjunction. Do have feminine hygiene products, some waste there. Obviously, there are

reusable cloth and then there are disposable napkins. We just supported a project with IRC Columbia to look at disposal and laundering of those items. If they are reusable they are not infinitely, it was not looking at it from an environmental perspective it needs to be managed, not just distributing this, and having it as the end goal. Specific project we have done in relation to waste management.

3. Can you discuss some of the disaster sites that you have worked at on the ground recently?

Frank: The worst I have seen was in Indonesian tsunami in 2005, with an NGO. People were sending in everything, clothing everything was destroyed. I was in a place called Chilang, a waste disposal site. Pallets and pallets of used clothing. It was a mountain, other types, and unneeded items. To include some hygiene items, people had no idea of the population. You needed a huge storage site, there will be waste from anything we bring in. To me, we need to be as judicious as possible for the packaging of items that are extremely necessary. I think however, one of the low hanging fruits is to look at the unnecessary shipping of items that cause overflow of waste.

Tracy: Good point Frank made, some of the waste is stuff that will never get used. A lot of the stuff is not asked for by relief organizations so much by shipped in by well-meaning groups. The whole cash is best approach would be better suited for some of those orgs. You cannot distribute different things to different people, it causes more problems, these small donors are often a huge waste.

Pablo: One of things is to diminish this shipping packaging, plastic wrap around the cargo, the strap, the tape inside each box. It reaches the destination; it has no use after this. It reflects on our community that we need to change.

Tracy: One of things I would say about this, the pallets get reused. When you get into the deeper field locations, the warehouses are using pallets to keep things off the ground. They get reused as

if someone was working with someone. I had a pallet in my own tent to have my suitcase off the ground. Things are happily reused and formally refused, while some plastics cannot be reused within the moment.

4. Can you give us an idea of how much waste is generated from a single hygiene kit?

Tracy: This will vary a ton. Also depending on things that are reused and are not. It is the items to ship it. When I think of the items in a hygiene kit, soap wrappers, 10 bars of soap, 2 plastic bags, bag for laundry detergent, package of napkins. That should be it in a formal sense from DHA, you get a few different ones when looking at a local procurement level. Quantity wise for a kit it is much larger on transportation.

a. How might this waste be mitigated?

Tracy: Looking into things that have a high priority for packaging that is biodegradable. Want to have beneficiaries not place this in landfills. More likely to have that sort of environment where biodegradable materials, soap wrappers that break down. Again, for me, the transport items, pallet, boxes, and such is trying to think of ways to be creatively reused so that they are not so specific that there are not reusable options.

Frank: A lot of the exterior packaging is because there is a lot of abuse while in transit. They are handled roughly, thrown back into a military aircraft, strapped down, etc. must have the interior packaging because they sit outside often. When I was in Northeast Syria, we produced hygiene kits, several thousand from DoD from Iraq. I checked them out they were soaked; they had been sitting in a gravel parking lot for weeks. The packaging was gone, what was inside them was fine. Everything that was inside was wrapping in plastic, reconfigured for distribution, a big aspect of packaging is that they are put in rough environments before the beneficiaries receive them.

Tracy: Do not want to save too much on packaging because that could have a detrimental impact on goods that will be received.

b. Are kits different for different climates, cultures, or disasters?

Frank: Right now, we have 1 generic kit, it would be too complicated. Our kits are really based on a sphere and history of what are the most common items. We do build in overlap, for mental hygiene, disposable pads more used than cloth. Have both items. Sometimes 1 is used, for Hurricane Matthew, we used both there. This is not our first thought; we prefer NGOs on the ground who know the context and when the kits are brought in there is a sizeable gap.

Tracy: I would say that up until 2 years ago we had more items in the kits, toothbrushes, toothpaste, toilet paper. We decided to streamline these items to reach the most amount of people and many did not use. When there is a desire for additional items, they do not need to be there in the first week, they could be sourced at a local, state level. Hard to have a population who is unfamiliar use it.

5. Did you have any experience where you felt the cultural practices of the local populations inhibited or promoted waste management?

Frank: The cultural practices affect whether certain items are reused. If there is a dearth of plastic baggies of that nature that people need to reuse, then they will get reused. When I was with IRC, a refugee camp. Maybe 80-90k the plastic was simple bags from the market, the wind would blow them all around. They would end up in the trees and fences. These greens bags were everywhere, we had our WASH coordinator started a women's group to have mats come from this. People needed mats in camp, and we had trash bags, not sustainable livelihoods program but the practice of having the bags everywhere they were not disposing them in a bin. Just throwing them in the streets, it was not helpful. I have seen in a lot of settings where things are reused, some are its just what I need and throw away what else.

6. From disaster sites you have worked at or are knowledgeable about, are there any environmental factors that may provide increased challenges to waste management?

Tracy: A lot of the places in which we were working did not have strong waste management before the disaster. If it is a natural disaster, we might have those systems overwhelmed, people are not getting their garbage trucks out. In places where the complex emergencies there is a lack of functioning government, it is not as a humanitarian actor that lets just get some trash bins set out for people because then who is coming to collect it. Is it just going to an overflowing transfer station and sitting there? Is it going to be buried in a big pile and prevent it from being displaced from wind or animals? We are looking at an entire system that needs to be addressed, not just collecting it, and disposing it. It is tangential to a lot of those immediate needs it does not get dealt with very well. That is one of the major challenges that I see.

Jacob: After Sandy there was trash leftover for weeks, very interesting point.

Tracy: Exactly, if they know that these things will not get emptied and their experience for years why should they take the extra effort. I think having those systems set up is a lot of work, do not want to put in on the individuals without having a larger enabling environment.

7. Do you have any experiences where reuse of packaging materials may be beneficial to a local economy? Are you aware of any attempts to repurpose waste to benefit response efforts?

Frank: Other than individual reuse I cannot think of any examples where they have been broader benefit for the economy or community at large.

Tracy: The only thing I can think of its not the waste from the kits specifically, we were having a project that an NGO supported was helping the waste pickers. Helping them with the formal economy, connecting those items to resellers, picking out metals or papers, the local market was willing to buy and get in industry. Going way back on a similar level, in Sri Lanka we did try to do a composting problem, more of a food waste.

8. Packaging waste created by NGO's is just as critical as the waste made by USAID, is there any interest among the NGO's you have worked with to go beyond packaging standards to find more environmentally sustainable packaging methods? What agency employs what you consider to be among the best waste management practices?

Frank: I do not have a good answer to that. I do not know what NGO; I think they are struggling about the same issues. It is very interesting, about 20 years ago I had a conversation with Morty Summer? Had a similar discussion about hygiene, she would ask questions that this is something we need to work on. This is a very tangential thing that this is where we currently are at. I do not know how many NGO are looking at this and how many are dealing with it. I want to know the extent of what they are dealing with.

Tracy: Similar reinforcement, NGOs are aware of their climate impact via carbon I do not know if packaging goes into this thought process. Oxfam would buy carbon credits to offset employee flights. It is costly for flying in environmental goods, there is an incentive to prevent things from going that would take up space, not doing it to be green but that has always been a part of it. You do not want to be spending extra money on pallets if you do not have to.

Frank: Key factor is that they do not want to disrupt the markets at all, they are more sensitive to this and markets when they bring it in. Is there incentive for them to not bring them in? A lot of the carbon footprint is not from packaging but from flights.

12. Thank you very much for your time. We appreciate your help on our project. Is there anything that has come to mind during this interview not addressed in earlier questions?  
Is there anyone else that you feel it would be beneficial for us to talk to?

Pablo: In your vast experience have you seen, anything say that was a good (disaster non disaster scenario) a lot of waste and the negative side that we all see. Do you see the spotlights of hope,

people recycling or people cleaning? Or is there a complete absence of it? I had personal experience with this as well.

Frank: I come back to the example from the refugee camp in northern Kenya Cocuma? That solid waste management was bad, what solved that problem there was a champion. A single individual, very dynamic and made things happen. Idk, this gets to the point of innovation and fundamental for making positive change. Everything happened there, she connected with people and turned it around. If you saw before and after picture, she really cleaned that camp up, she did not do it alone, but she initiated it. It takes someone to do that and then people join, you do not find people throwing trash in their compound or near their space but in the common areas. No one wants it there and people need to step up, if the acute phase of the emergencies we focus on public health for WASH, there are not specific and serious issues for public waste compared to clean water and hygiene. We do not focus on that up front and center, some places Solid Waste Management is a primary concern. The point is, I feel that the refugee camp in Kenya, we had a champ and turned everything around.

Things mentioned that do not deal with the questions:

Collaborative workshop, 15 different partners and Pablo can speak more on that. Donors, NGOs, implementing partners, 5-6 different UN orgs and the humanitarian assistance. Someone from IOM said go speak to WASH because they have been dealing with solid waste management, very timely. We hope to continue this conversation as we improve our environmental performance.

Tracy: I got the 1 pager, 2 pager it would be useful to have that quick overview where you guys are, planning to go so we can target this info that we are talking today.

Pablo: students have some good questions, so I will not take up much of their time. This is one of the few initiatives we are taking for green logistics and I will give them some space to explain the project and to have their follow up questions.

## Appendix F.3 MIT Lincoln Lab Discussion Minutes

1. Introductions. Osa, Lorenzo, Jake
  - a. What have we personally researched? IE: I have researched a lot of reuse methods for cardboard packaging such as creating backpacks from cardboard boxes and using cardboard in a composting pile.
  - b. Osa, I have researched methods for plastic and metal waste management. I will focus more on metal. I study the compacting and shipment of metal waste especially aluminum can because of the demand for the metal and its recycling capabilities. I also investigated waste to energy ideas.
2. What spurred your research into this field?
3. What kind of ideas did you have when you first started researching? What were some of the criteria you were looking to solve? How have these changed as your research has progressed?
4. What forms of packaging are you looking at minimizing or being able to process with recycling methods? Can we discuss the methods you are looking into or developing?
5. Can these methods be performed on the ground or does it require a more formal site?
6. Are there any events that you have researched that highlight the need for sustainable humanitarian packaging?
7. What are the other stakeholders besides USAID that you are working with to help find recycling methods for Humanitarian packaging?
8. Are you focusing on recycling in a specific environment? What would implementation of the methods you are researching look like?
9. When, to your knowledge, did waste management become a major focus of humanitarian actors? Are there other groups with related projects?
10. Solar power electric shredder, could work well with plastic brick compactor idea

Brice: A lot of the times we work with students that come up with solutions. MIT trying to cool medicine or samples that would be used for diagnosing individuals, they thought they were

building hardware, it is the system. You can design the bracket what are you going to attach it, who is trained to use the tooling to attach it. How will it be incorporated. When you say systems, you are on the right track. If you do not think from start to finish you are confining solution to a narrow niche.

Jacob: We are looking to propose 1-2 systems to process plastics and 1 for cardboard + metal. And come up with a way to collect these resources.

Brice: We look at the gaps within our processes that we have developed. Who will do what roles, maintenance, training? If you look at the process and the Puerto Rico hurricane, and people are trucking in aid, bottled water. How do you do collection at the site. How do you get your equipment in there, how do you process it if no power, if roads are down, how to get materials are out? Is this a permanent facility or a temp, what about storage of these goods? Have you thought of the timeline of events? What does it mean for the hardware, how do you do collection, how do you find out where you need to go?

Jacob: In terms of machinery, they would fly in with the people who are doing the rapid onset. We can use about a pallet's worth of space.

Brice: you are further down the line with groups we have previously worked with. You are thinking of buy back systems to get people to have incentive to come back.

Megan: They love the tech but how do they use it, eventually we need to prepare the tech needed for this. The system relatively know how it will get to Puerto Rico.

Brice: I think you guys are doing great. You arrive and now you must get it out. It is perfectly ok to identify them and say we do not have answer for this. Limited time and scope. Within our final presentation it is ok to say a risk analysis. We are looking at this process, there are certain things we do not know. This needs to be focused on because this is core. We have answered critical problems now we just need the fill ins for the transportation. This is how we envision it, and it needs to be expanded on.

Brice: Big believer in trying to identify a process you want; they reduce to one we can have. We have 2 different models. You unload gear and in Port-au-Prince Haiti. It was hard to get out of

there to the unrefined areas. You start in Port-au-Prince, two different ways, could have palliatives kit that can be loaded on a kit and taken to different vantage points and do processing. Other is centralized facility with trucks going out to collect.

Jacob: Looked at both options, it will depend heavily, The urban setting, a lot easier for a central system. The condition of the road networks, for trucks if the trucks cannot get there.

Brice: Transportation becomes a problem.

Brice: Power. You were talking about power, what are your options for power are. Mainly we have thought no access to power, 1-2 solutions that use electricity but alternatives that use power.

Brice: Where are you storing it. The storage location and how much volume that would require. We looked at shredding polypropylene bags.

Megan: Solar shredding solution. Working with USAID, they distribute a lot of food around the world to folks in need, you have the packaging waste associated with it. Not a requirement to deal with it, we are putting a burden on these communities. We see gardens, sandbags from plastic bags. Use different materials that do not need processing, biodegradables, how to deal with it now with recycling. Examined different capabilities, a kit, mobile facility, brick, and mortar facility. Tested this out and moved forward with recycling truck, mobile facility. Some of the reason where it is a truck, it can move around, does not require people to bring materials, the other is we built the facility it would be more cost effective. At this point moving forward we have worked with energy systems engineers to scope it out, what required power do we need. How do we meet this with solar, how frequently during the day do we use this? How do we ensure this is a safe system? How do we figure out if this truck is deployed in an amount of time, how does collection work? Piloting this and testing this out is key, overseas we will want to make sure it works here and have components and maintaining system. Does the community want to recycle are they interested in secondary benefits of jobs?

Brice: Looking at small recycling shredders, only taking about 1700-2000w that is a solar mini fridge, 10 panels that are flexible, durable, and highly efficient. They are lightweight, this is a palletized kit, batteries for storage when we do solar. In a disaster system with a lot cars around,

we can save weight, can populate it with batteries for site but it will last for a couple of weeks and then replace them. Not a lot of power, equipment is cheap and affordable, these kits could be made a lot of.

Megan: Reverse logistics, how these communities are accessible. The settlements and central facility. Do we have reverse logistics? If we have central who is bringing the materials. This might work if it is somewhat localized. Fuel access is tough for trucks, heavy demand on fuel. 2. Responsibility, who will operate this? Particularly in humanitarian sector, people has been through a disaster while they are trying to rebuild lives to focus on waste. 3. Awareness, part of the system you have if some of these communities is unavailable, they can collect their stuff for when its ready. These people must know this system is here to get the waste out. 4. Impact! We do not do tech for tech but impact if you have an idea for the solution for the waste after its recycled vs what the impact of your solution. How do you quantify those?

Jacob: Need to focus on whose responsibility it is! Whether that is USAID, or someone hired by USAID to supervise.

Brice: as the aid is being distributed to have a mobile unit to collect waste at point of distribution and use. Collect as much as possible, pack it and put it in the truck that is leaving anyway.

Brice: I heard about the bricks, are you looking at making bricks on site.

1. On site you might need to do cleaning of material of cans.
2. I really think it might, all sat around for an hour and crank this out. You might have done this. Pick an operation, go start to finish. Arrive in Haiti, the next step is getting equipment, next is getting to site, next is deploying, next is power, next is manufacturing onsite. Take each step as we see it and under each one does the who what where why analysis. What will we need onsite? Think about the environment we are in and each of the things we need to accomplish this stage and WHO? What it is showing, have we come up with a comprehensive solution? This is a whole process it would be good to figure out what we are missing at each section. I need a cleaning station; I need a broom handle in case shredder gets jammed. It helps take the 200,000 ft level and what do I need and how best can I make that at a very local level. We do not need to create tech, we are

trying to adapt the tech in the best, smallest efficient way. They call It systems analysis, shows different options. Risks advantages and where we need focus our attention.

Brice: We are trying to develop a solution, feedback from this that we might not recognize. I want you to get critical feedback on our system and how we might make it better.

#### **Appendix F.4 David Bock, International Disaster Response Manager at Samaritan's Purse, Interview Minutes**

Hello, we are Jacob, Osa, and Lorenzo. We are students in our Junior year at Worcester Polytechnic Institute. We are working with USAID for our Junior year project. USAID has asked us to investigate the feasibility of a new waste management system for rapid disaster response areas. To do this, we have been gathering information on the current and recently used disaster area waste management systems. If you are willing, we would like to ask you a few questions about waste collection and processing and allow you to express any opinions you may have. This interview should take about 45 minutes to 1 hour. Please inform us if you wish to remain anonymous. If you do not mind, we would like to quote this interview. You can also refuse to answer any question or let us know if you wish to stop the interview.

1. How long have you worked for Samaritan's Purse?

a. Mr. Bock, we understand that you are the International Disaster Response Manager at Samaritan's Purse. Can you tell us about your time working there?

An affiliate of the US version of Samaritans purse, we input with people that are part of those responses. We do some activates by paying for flights for some people to assist and that is our goal. I work on training for a roster of Dart Disaster assistance response team. We call out and see availability with our international headquarters and send them out. I am response manager for Armenia, still working with our teams and their responses there. Been working with Gifted Kind as well another initiative. Sometimes I work on local responses, not here in Canada but overseas with our partners.

2. Working with a humanitarian organization, we imagine there are a lot of responsibilities, especially when a disaster strike. Can you tell us about your role in Samaritan's Purse disaster response?

When a disaster happens, a bigger disaster Samaritan's Purse will decide whether we will respond or not. Depending on what the task will look like, if we are inputting money this admin person will create a proposal. Disaster Response, it is in our DNA it is what we do, big part of who we are. Big domestic response as well, important to help with Floods or fire. Cleaning those basements, sifting through people's ash, a lot of volunteer driven within Canada. Outside of Canada it is more employee hires.

3. If any, what are some notable disaster sites that you have worked at?

Within Mozambique I was there last year for one of the storms. This last year we had Beirut. For big DART responses there was the Aussie wildfires, sent a COVID-19 unit to Italy with several staff. Pivoted a lot of international projects and activates to COVID-19 for food distribution, hand washing stations etc. NYC had 1 person, had emergency response hospital set up. Did a northern Canada response kits for COVID-19? Saying IPC infection prevention control, sent teams to Alberta and the Bahamas, set a ward up there. When I was in Beirut provided over 5000 tarps to households, some cash distributions and medical response attached to that. Most recently an Armenian Response, we had a plane go out today.

4. One of USAID's major waste concerns is packaging, can you tell us about the forms of packaging used by Samaritan's Purse?

- a. Why does Samaritan's Purse use this packaging method?

When I think about a disaster site, I think the packaging is the least of the concerns. So much metal and debris, for MZ on the beach, metal on the roofs that dug into the sand. The whole beach was full of metal and needed to be cleaned. As far as packaging goes it can be repurposed, the USA tins are frequently used for other purposes, the tarps fray eventually. The plastic tarps last a lot of years. Sometimes you are not even on the ground within the first 7-10 days, its local efforts. There are times we do operate within that window. Those things matter but I wish you

were working on the bigger issue of waste. There is so much, i.e., in DR and there is still so much cleanup that needs to happen.

I was not around for Haiti, the problem is not about the first 7-10 days, the junk dropped from all over the world from all the smaller actors. I was talking to someone who just sent 10k pairs of glasses to Haiti and does not have lenses and send them to DRC <said this laughingly because it is a problem>

5. Have there been attempts to limit the usage of packaging? What was the result?

Regarding the packaging has there been any movements towards the packaging or swapping things out. I do not really deal with that; size is more importantly part of the decision. The response and speed are key, the packaging is not the forefront thought of what we do when we are trying to respond to a disaster. We try to be first on the scene.

6. Can you give us an idea of how waste was being processed at some of the sites that you have worked at?

We have done a lot of debris removal off Navico in the Bahamas elbow key. Most of it was, I believe, went to the landfill, with the fridges taking out the Freon and the bulk of it. I do not think that, idk I asked somebody when I asked someone. I never really got into it, there must be some way for us to do a portable recycling plant that could be moved from island to island for us to do stuff like that. Must sit on a barge for us to be ready to go. One of the issues is the scale for a limited amount of time, it would not be needed after the disaster has ended.

7. What would you change about this waste processing system?

Can you talk a bit about the waste being created at disaster sites? We are looking at couple do systems and are trying to get an idea of the makeup of waste. \*Asked about systems so we elaborated on some\*

Distributing 2 tarps, rolls of plastic. The cutting could easily be recycled, that would make sense to be done. Then they are tied together with ropes and then folded, about 100 footlong 20 foot

wide, cut into 20 x 20 so you get 5 tarps. Can quote him on that. The waste is only the tarp after the response, it will be continually used as it can be used for a long time. There is a hygiene kit, sanitary pads, toothbrush, and a small number of plastics depended on use. Probably keep the box with the stuff with it until its used. The box is cardboard waste. Those are the main things we provide; the blankets are wrapped in heavy plastic to prevent expansion. I think they come in 12 bundles packed together, there is a bunch of plastic to use at the site. Instead of distribution at point of use, at least start using the plastic at the site where it is being processed for distribution. I think the biggest issue with this is what SCALE, and if we are making a bunch of bricks, we just created a new waste product. Bricks are the cheapest, so many turning it into something other than brick might be good.

8. We are looking at proposing new solid waste management systems to USAID, what are some limitations that we should lookout for? (Cultural, Environmental, Economic)

Start talking about materials, how would it be built. What is the plastic house limited to? Culture considerations, with the workers. I think collection is an issue too. Thinking about waste materials from distribution, majority of the waste will happen out the household level. Talking about collection is a massive issue early on. If this is a general waste plan but I do not think of plastics as the first thing (does not take a lot of space when recycling after a disaster). Your collection would be a problem. Idk if I have pictures of waste piles. A lot of wood waste that has been torn down. There is another thing, what is the normal uses of housing. Are they used to using bricks or wood? Soil bricks, it might work well, you could train soil bricks to do this. Soil is an unlimited resource. What are we competing against? Maybe its somewhere halfway, does not have a concrete brick strength but better than a soil brick. What is the motivation for making the bricks? We are looking at a buy back system we would give some monetary compensation. The machine could be part of the waste problem, we worked on a tarp cutting machine, I had the concept, and someone put it together. I did not have the mental energy that the way they were using it in Beirut. I thought it was a good idea and they used it differently I could not tell them otherwise. In some cases, you have unlimited labor. Your priority is saving people's lives, we send a small team we need to send another person to run this program it is going to be a challenge. It will not be impossible but a challenge. It is what our organization is, saving lives.

How would this be managed, or you would hire staff because there is a big transaction of money taking place. Must think about normal distribution. You want to trade something for that, then bringing it back, have a truck bringing this stuff out. A few components here.

9. In other parts of the world recycling is not commonplace, how did local attitudes towards recycling and waste management affect waste management efforts?
  - a. Did people seem interested about waste management in the places you have worked?

I think it must be modeled as a waste project. You still have people dealing with waste, need the infrastructure for doing some of these things. You cannot count on culture having the same impact everywhere you would be.

10. What viewpoint do you feel humanitarian aid workers in general take on environmental sustainability? Do you share this viewpoint?

You got that right about a lack of caring about waste! We love the environment. As far as the first 7-10, after the month you want to think about the impacts. The prioritization is on saving lives.

11. Thank you very much for your time. We appreciate your help on our project. Is there anything that has come to mind during this interview not addressed in earlier questions?  
Is there anyone else that you feel it would be beneficial for us to talk to?

Develop a pitch for a possible contact for a shelter contact and I can send it over to him to see if he is interested.

Scale is very important. What kind of scale?

For erosion it depends on the type of road.

Osa: In Nigeria we have a lot of bad roads and they use stones, dirt, and gravel.

It could work, the question is do you want plastic, I think something concrete as a bit more environmentally friendly. How cool is mud brick, they are just mixing concrete? Everything that

you put in the responses is replacing something else. That is something that we always think about.