ID	Category	Risk Item	Effect	Cause	Likelihood	Severity	Importance	Action to Minimize Risk	Mitigation Plan	Owner
	What type of risk is this?	Describe the risk briefly	What is the effect on any or all of the project deliverables if the cause actually happens?	What are the possible cause(s) of this risk?	L	S	L*S	What action(s) will you take (and by when) to prevent, reduce the impact of, and/or transfer the risk of this occurring?	What action(s) have been taken to mitigate, prevent, or reduce impact.	Who is responsible for following through on mitigation?
1	Technical	HRS distrupts air flow	The kiln will not produce quality biochar	HRS interfere with airflow location	1	9	9	Aquire more info on airflow	Keep exchanger hanging in center of kiln.	Kyle, Kent
2	Technical	HRS doesn't fit with multiple sized kilns	Device will not be fully utilized	Design not modifiable Heat transfer not scalable	1	1	1	HRS designs for various kiln sizes	Heat exchanger does not interact with kiln. Dimensions can be scaled.	Kyle, Kent
3	Resource	Not enough time for team to learn how to properly use kiln and run multiple tests	Fall behind on MSD deliverables	Approval to burn, time commitments, access to materials	1	9	9	Start as early as possible to get materials and location to burn.	Team has conducted 2 burns by (11/8/15)	Team
4	Technical	Water flows too fast to reach temp or time requirements	Water will not be pasteurized	Poor heat transfer Poor fluid containment	3	9	27	Consider valves to contain water in system until up to temp for long enough	Will be using thermostat and relief valve.	Kyle, Kent
5	Safety	User injures themselves on HRS System	Device is not safe for the user	Hot portions of HRS exposed & unlabeled HRS has sharp edges/protrudes from Kon Tiki	9	9	81	Understand temp profile of HRS Design HRS to be out of the way	Use colors or various insulation materials for hot areas. Include operational instructions	All
6	Resource	We lose one of our customer contacts (Subject Matter Experts)	Team needs to find other methods of collecting data	SME has to travel or has other time commitments	3	9	27	Diversify our contact list	Team has reached out to global contacts and received information about practices in different locations.	Kyle
7	Safety	Temp of water not high enough to kill pathogens	Output is not useful or safe for the user	Temperature is not hot enough	3	9	27	Increase time water is exposed to fire	Inclusion of bleed valve (for cold water) and thermostat to regulate hot water	Kyle, Kent
8	Technical	HRS breaks and nobody knows how to fix it	Device is not useful for customer	Design is over complex Design is not robust SOP is vague	1	9	9	Reduce number of components in system Write easy to follow SOP	System is simple and straight forward to use. Operational instructions will be included	All
9	Environmental	Can't have animals live in device	The HRS can not be operated	Wide open areas accessable to animals	1	9	9	Include mesh over tanks. Caps over heat exchanger inlet and outlet. Mesh or chicken wire over leaf box		All
10	Resource	No access to cheap materials for build	Device will be too expensive for customer	Materials cost more than expected Poor BOM Poor sourcing	3	9	27	Identify different materials that are suitable for our needs Identify materials available to Nepal	SME has provided information about local materials. Research has also been done to understand local materials.	Kent
11	Safety	Installation cannot be strenuous for the user	Device is not easy for customer to use	Large components (or heavy) Difficult location to mount	3	9	27	Consider these causes in BOM, instructions, and modular design	Use lighter materials. Keep all devices lower to the ground.	All
12	Technical	HRS system is durable to withstand standard operating conditions & installation	Device is not useful for customer	Design is not robust	3	9	27	Use sturdier materials	Many devices will be made out of metal. Assembly instrutions will specfiy weld types.	All

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13	Resource	Not enough material to burn for a sufficeint time to collect data/heat	Waste time and have to redo tests	Lack of planning	3	3	9	Plan	Conducted validation test by 11/8/15	All
14	Resource	Area may not allow burning / no facility to use kiln	Will not be able to conduct testing	Restrictions/laws	1	9	9	Start as early as possible to get materials and location to burn.	Burning at customer's hosue	Courtney
15	Technical	HTX is inefficent	Device is not useful to customer	HTX is too far from heat source. HTX design does not utilize heat caputred. Too much waste heat expelled to environment.	1	9	9	Perform calculations to understand risk. increase pipe diameter. Insulate the system	Performed flow and heat transfer calculations to validate design decisions.	Kyle, Kent
16	Technical	Tea leaves catch fire	Device not useful or safe to customer	Tea leaves too close to heat source.	1	9	9	Design tea leaf enclosure to be far enough away from heat source	Tea leaves far enough from heat source. Acts as oven.	Courtney, Zak
17	Technical	System not properly sealed	Inefficient heat transfer. Potentially unsafe. Loss of internal contents.	Improper installment. Modular system not ruggedized	3	9	27	Design ruggedized instillation. Multiple sealing failsafe methods.	Aquire square to round couplings and test specialized components	Kyle, Kent
18	Technical	System damaged on biochar removal	Device is not useful to customer. Difficult to repair	Improper removal of biochar. System interferes with typical removal process.	1	9	9	Design modular HTX system. Overcompensate wall thickness. Ajustable height for system.	System is light enough to be moved prior to biochar removal. System is not connected to kiln in any way.	All
19	Technical	System design is not versitle	Product is not useful to large demographic. Decreased effectiveness.	Will not adapt between pit vs kiln applications (too tall or too short). Not adaptable for kiln geometry (round walls vs flat walls). HTX too wide or narrow.	3	3	9	Design coil output location to be versitle. Consider gravity height displacement for proper output. Modular system (different HTX based on kiln diameter.	Assembly instructions include information for both a kiln and a pit.	Kyle, Kent
20	Technical	Tea leaves are not within the temperature range required	Device not useful or safe to customer.	Tea leaves too far to heat source.	3	9	27	Design tea leaf enclosure to be close enough away from heat source.		Courtney, Zak
21	Technical	Tea leaf flavor changed	Device is not useful to customer.	Smoke/smell from burning embedded into tea leaves	3	9	27	Use an intake air pipe	Bottom of box is sealed and air intake valve is included	Courtney, Zak
22	Safety	User is injured removing tea leaves	Device is not safe for customer.	Tea leaves are too high for user to reach. User has to lean over hot kiln to collect tea leaves.	3	9	27	Keep tea leaf enclosure lower to ground. Mobile tea leaf enclosure.	Door on side of box will be included	Courtney, Zak
23	Safety	Water trapped in system & molds	Device is not safe for customer.	Not ideal gravity fed system. Not modular/easy to clean.	3	9	27	Modular system. Add cleaning instructions.	Heat exchanger is modular. It will be easy to drain water from system.	Kyle, Kent
24	Safety	Tea leaf enclosure knocked over	Device is not safe for customer.	High center of gravity. Mounting not secure.	3	9	27	Keep low to the ground. Sturdy mounting. Consider wind gusts.	Keep center of gravity low	Courtney, Zak

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25	Safety	HTX falls into kiln	Device not useful or safe to customer.	Exterior structure is not structurally sound.	3	9	27	Design for a factor of safety of 2 or greater.		Kyle, Kent
26	Technical	Thermostat fails to work	Device not useful or safe to customer.	Thermostat overheats due to proximity to kiln. Initial water/air in system never comes to temperature.	9	9	81	Preheating HTX before lowering. Raise thermostat temp. Moving thermostat further away from kiln. Lower thermostat below heat shield. Insulate thermostat.		Kyle, Kent
27	Technical	Flow rate through dehydrator	Flow rate too fast for it to heat up from plate. Flowrate too slow to evaporate moisture.	Length and diameter of chimney and intake pipe. Amount of heat in the box.	9	9	81	Optimize chimney and intake pipe dimensions.	Volumetric airflow calculations.	Courtney, Zak
28	Safety	Sheet metal of box is hot	Can burn whomever handles the box	Fire in the kiln	6	6	36	Insulate the edge of the plate or wear gloves when handling the dehydrator		Courtney, Zak
29	Safety	Toxins enter the dehydrator	Toxic tea leaves	There are holes in the box, allowing smoke to permeate	3	9	36	Make sure the dehydrator is air-tight	Added intake pipe	Courtney, Zak
30	Safety	Un-Stable Feed Tank Rack	Water Feed Tank would become unstable and could fall on someone or fall on ground damanging tank or other components.	Water causing slipping. Structure can not handle weight. Structure is not stable	3	9	27	Over design structure to compensate for max weight of water		Kyle, Kent