Uranium Water Treatment

March 1, 2016

Overview

Part I. Description

The Navajo territory has been greatly affected by the Uranium mining that occurred during 1944 to1986; there are over 500 contaminated sites all over Navajo Territory. Uranium leaked from the mines into the water, land, and atmosphere. The Navajo people have been suffering for decades from lung cancer, bone cancer, tumors, and organ failures all linked to Uranium contamination. The US EPA has set up several 5 year plans that have been implemented unsuccessfully due to lack of attention to the problem. As chemical engineers we believe we have the power to clean the water of the Navajo Nation. Our Uranium Water Treatment Project group is confronting the problem directly by researching, designing, and trying to construct a portable device that will help prevent further anguish for the Navajo people.

We believe we can design a portable device to clean the retention ponds in the Navajo Territory even in the most desolate areas. Our design will clean the water and residue, extract the uranium so that it can be sold to maintain the plant, create jobs for the Navajo people, and provide a safer environment for the younger Navajo generation.

Part II. Purpose and Benefits

The project will significantly help to better the environment of the Navajo people. They will no longer have to worry about not having water or having to risk getting deadly diseases when they are forced to use the uranium tainted water. The resin used in our device to extract the uranium will also be environmental friendly because it is reusable. Our device is working towards creating a cleaner and safer environment by removing the uranium and other hazardous metals from contaminated water and soil. The device will also help the social economy because it will create jobs for the Navajo People and the uranium that is extracted can be sold for profit. Through our project UC San Diego will reduce the negative environmental and social impact in other areas; thus, supporting more communities and improving the lifestyles of Native Americans.

Milestones

Milestone	**Estimated Date of Completion**
Project Start Date	December 2015
Idea Proposal	December 2015
Pitch Day	January 7, 2016
Design/Project Proposal Completion	February 6, 2016
Target Date for Project Completion	June 10, 2016
Target date for submitting final project to Navajo EPA and local orgs	June 3, 2016

Part I: Quantifying Success

The quantifiable sustainability impacts that the UWT team is aiming for is to clean all 520 sites during the first year and then keep maintaining the sites well below the max contaminant level for the years after that. Our success will be measured through a targeted 90% reduction of uranium contamination levels in the water. Thus, the water will be safe for drinking and daily use. Another outcome would be that about three devices are created, for which 4 to 5 people will be needed to maintain the devices. Thus, we are looking to create new jobs for about 15 people from the Navajo Territory. A successful project is one that fulfills all these requirements and has a positive impact to the people and the environment.

Part II: Contacts in Navajo Territory

We are getting approved by the Navajo Nation EPA Waste Regulatory and Compliance Department and the Surface and Groundwater Protection Department. So far, Selene and Daniel have contacted David Tierney, Lily Lane, Darlene Jenkins, and Diane Malone and have been getting in contact with other organizations in the Navajo Territory such as Dine No Nukes.

Project Team

Part I: Contact Information

Name	Major/Expected Graduation Year	Project Position/Role	E-mail
Daniel Sundahl	Chemical Engineering, 2016	Co-manager	dansundahl92@gmail.com
Selene Lopez	Chemical Engineering, 2017	Co-manager	lopez.selene.b@gmail.com
Brian Contreras	Chemical Engineering, 2017	Research/Design	bscontre@ucsd.edu
Brittany Stump	Chemical Engineering, 2017	Research/Design	bhstump21@gmail.com
Cyndi Gonzalez	Chemical Engineering, 2017	Research/Design	cyndigonzalez15@gmail.com
Ericca Speed	Chemical Engineering, 2017	Research/Design	ericcaspeed@live.com
Jeremy Wan	Chemical Engineering 2019	Research/Design	jeremymwan@gmail.com

Part II: Timeline of Events

Name	Duration	Start	Finish
UWT Project Starts	1d?	01/11/20	01/11/2016
Week 2 - Meet members and show everyone the project	5d?	01/11/20	01/15/2016
Week 3 - Recruited more members	7d?	01/18/20	01/26/2016
Week 4 - Assign different research methods to each team member to study and bring info for next meeting	7d?	01/25/20	02/02/2016
Week 5 - Pick a method to start designing	7d?	02/01/20	02/09/2016
Week 6 - Trouble shoot design and play devil's advocate	7d?	02/08/20	02/16/2016
Week 7 - Finalize detailed design	7d?	02/15/20	02/23/2016
Week 8 - Economic analysis complete, begin applying for funding	7d?	02/22/20	03/01/2016
Week 9 - Online work, no meeting, Social Innovation Challenge work	7d?	02/29/20	03/08/2016
Week 10 - Begin working on a video to send for SIC	14d?	03/07/20	03/24/2016
Week 11 - Finals week - no work on project	7d?	03/14/20	03/22/2016
Week 12 - Spring Break - Finalize materials needed for SIC - find lab space	7d?	03/21/20	03/29/2016
Week 13 - Begin Spring Quarter - send materials to SIC - keep looking for lab space	7d?	03/28/20	04/05/2016
Week 14 - Use funding for purchasing materials	7d?	04/04/20	04/12/2016
lab work	7d?	04/11/20	04/19/2016
lab work	7d?	04/18/20	04/26/2016
lab work	7d?	04/25/20	05/03/2016
lab work	7d?	05/02/20	05/10/2016
lab work	7d?	05/09/20	05/17/2016
lab work	7d?	05/16/20	05/24/2016
Showcase showdown - Prototype presentation	7d?	05/23/20	05/31/2016

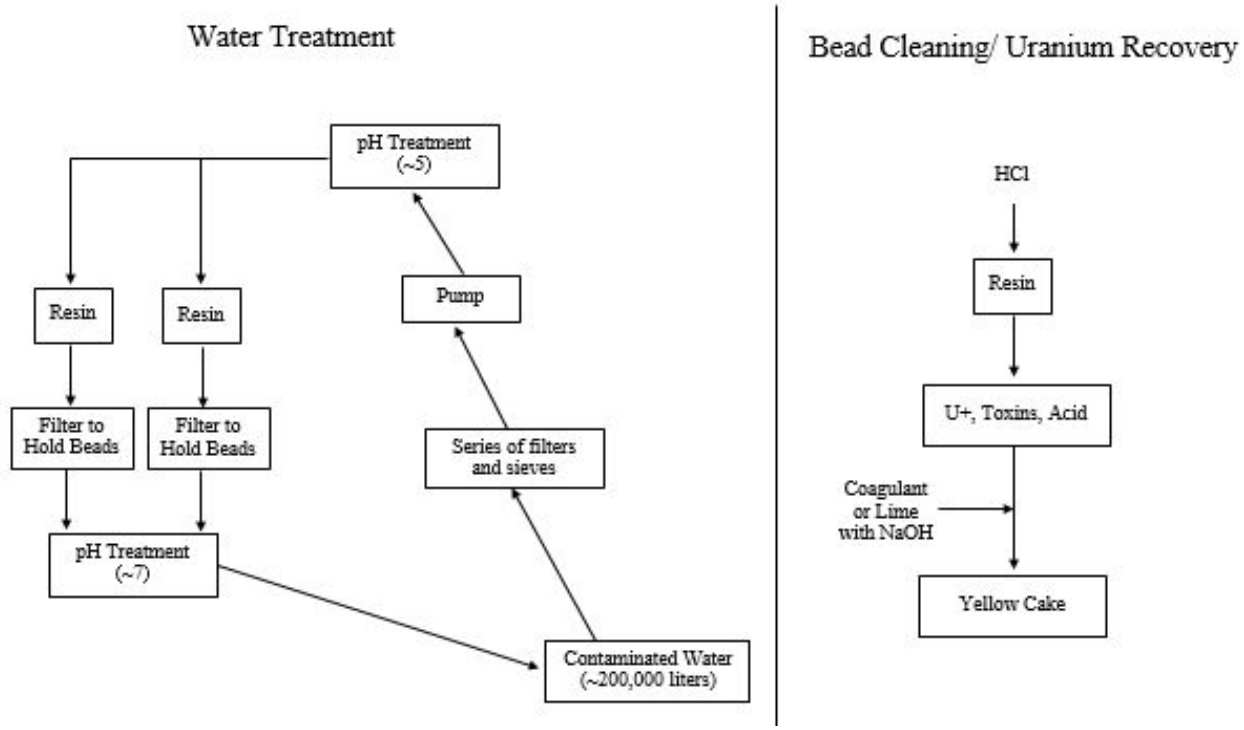
Specifications

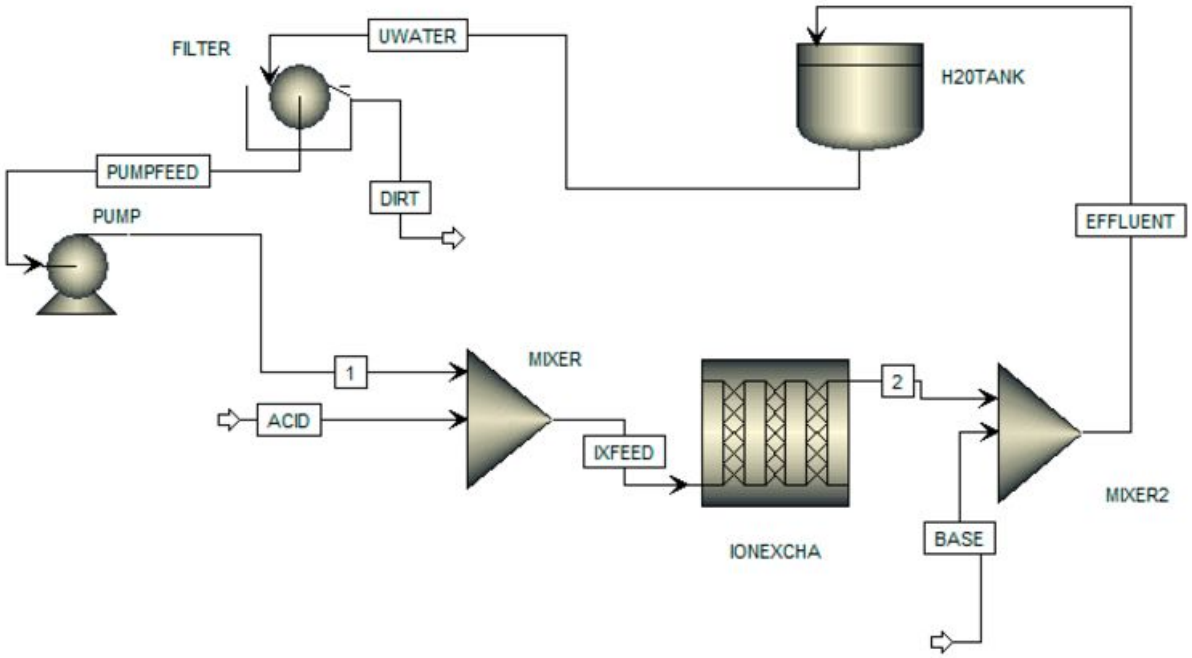
Part I: QFD Chart

Quality Function Deployment Chart that our group worked on together in order to combine our research and decide on which uranium extraction method we should use in our device.

Treatment Methods	Cost ($/kg)	Uptake (mg/g)	Ideal pH condition	Ideal Operating Temp	Max Operating Temp
Graphene oxide (GO)	~10,000 vs ~4720	299	4	298 K the higher the better	Carbon breakdown
GO-ACF	need to synthesize	298	5.5	297 K, the higher the better	breakdown of carbon
Graphene iron oxide	need to synthesize	69.49	5.5	293 K, the higher the better	Until carbon breaks down
oxidized activated carbon	15600.00	25	5.5	298 K, the lower the better	320 K before uptake goes down
Titanium oxide	18.78	60	8	293 K	
Iron oxyhydroxide	9.00	278		298 K	
Amberlite XAD-2	181.40	(99.2%+/- .4%)	4.5 - 5.5		
Amberlite XAD-4	194.50	50	3.7	297 K	
Amberlite PWA-8	not enough info	not enough info			308.15K
Amberlite PWA-12	not enough info	not enough info			
Amberlite PWA-17	not enough info	not enough info	0-14		
Amberlite IRA-120	59.80				394.15 K
Amberlite IRA-400	221.00		0-14	above 333.15 K	350.15K
Dowex A-I					
Lime softening (Calcium Hydroxide ar	256.40	0.83 (per gram Ca(OH)2)	>10.6	340 K	
Lime softening (Calcium Hydroxide ar	281.60	0.83 (per gram Ca(OH)2)	>10.6	340 K	
Coagulation(using ferric sulfate)/Filtra	.10-.50 (for ferric sulfate po	66.4	6 or 10	293 K	313 K
Coagulation(using aluminum sulfate)/I	0.15-.20 (for Al Sulfate)	78.85	10	293 K	313 K
Dowex 21K XLT (OH- form)	410	50	0 - 14	323 K or lower	333 K

Diagram displaying the setup of our device:




FILTER
UWATER
H20TANK
PUMPFEED
DIRT
PUMP
EFFLUENT
1
MIXER
ACID
IXFEED
2
MIXER2
IONEXCHA
BASE