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## **A Plastic Struggle for Mother Earth**

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### **Introduction**

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Plastics are a huge part of our everyday lives. Many of the products we use daily are made out of or contain plastics. So what happens to the plastic product when we are done with it? This is a concern for many environmentalist because plastic has become one of the major substances to have a negative impact on our earth's environment. We hardly ever think about how something as simple as a plastic bottle or a one-time use plastic bag can play a major role in the ecological devastation on earth. Why then are we not trying to control the use and disposal of this damaging material, known as plastic?

When we think about this question, we have to consider the convenience of using plastic in our daily living. The convenience of bottled water packaged in lightweight plastic, which can be easily carried and can be thrown away as soon as the water is consumed, thereby eliminating the need to carry it around. Consumers also like one time use plastic bags because they are more durable, lighter and take up less storage space than paper bags. Is convenience worth it, knowing that more than one-third of all plastic disposable packaging like bottles and bags end up littering the environment? We will be discussing this question and other questions pertaining to this environmental issue in this curriculum unit.

An important part of this unit is to bring awareness of this issue to my 8<sup>th</sup> grade students and their community on the Navajo reservation. In recent years, there is an increase of environmental issues dealing with single use plastics in nearby communities and on the vast land of the Navajo Nation. It is my intention to inspire students to become actively involved in learning about their surrounding environment and to engage in solving real world issues through environmental engineering. The curriculum unit is in alignment with the Next Generation Science Standard, on human interactions and their impact on the environment. In addition, this unit integrates the Navajo cultural teachings to support my students in understanding the importance of continuing our ancestral ways of keeping harmony with Mother Earth (*Nihima Nahasdzáán*).

## Context

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Our school is under the Bureau of Indian Education (BIE), classified as a K-8<sup>th</sup> Elementary School located in a rural area, about 17 miles east of the nearest city. Our student population is 100% Native American in ethnicity, coming predominantly from the Navajo or Diné tribe. Because of the geographic location of our school, the school is able to serve five Navajo Nation communities within its boundary. The school campus is fifteen years old now with many of the facilities still in good condition. The school serves K-8<sup>th</sup> grades, including a Family and Child Education program. The school has a population this past year of 424 students. As for our student body academically, we have 16% Special Education students, 98% designated English Language Learners (ELL), 10% Gifted and Talented (GT) students. Demographics also include a majority of students coming from low socio-economic families, which allows for a 100% free lunch program qualification.<sup>1</sup> On an annual basis, about 10% of the student population enroll in the residential program. The residential program houses students during the week but students return home for the weekends and holidays. The other 90% of the population are day students that either ride the bus, are dropped off by parents or are walkers from the nearby community of Ft. Wingate. According to school enrollment documents, more than a quarter of the student population are being raised by extended family members or under foster care.

This unit is planned for my 8<sup>th</sup> grade homeroom science class for a duration of three weeks. There are usually about 58 to 65 students enrolled in 8<sup>th</sup> grade from ages 12 -15. Since our data indicates a majority of the student population classifying, as English Language Learners (ELL) then I would estimate about 60 of my students will be in this category. This information is important in developing my curriculum because I would need to incorporate ELL strategies into my lessons. The schedule for middle school 6<sup>th</sup> through 8<sup>th</sup> grade is semi-departmentalized. Students have five periods with Math, English Language Arts (ELA), Science, Social Studies and an elective class. In the Middle school section, classes are 55 minutes long for each core subject and 30 minutes of intervention classes for Math, ELA, and Science. Students rotate between these core classes in the morning. In the afternoons, they stay in their homeroom for social studies or science class. The schedule is strategically plan this way so teachers would have more time with their homeroom students and get to know them as individuals. Thus, teachers play a very important role in a student's life not only academically, but also in supporting the development of our student's characteristics and their holistic well-being.

The beginning of the year overall Northwest Evaluation Association (NWEA) science assessment data shows our 8<sup>th</sup> grade students are in the Low category; 70% in Low Average, 20% in Average, 9% in HI Average, and 1% in HI category.<sup>2</sup> This data demonstrates a need in supporting our students in learning more about the science around them.

Another important factor regarding my student data information is their cultural background. We are at a point where our youth are losing their cultural knowledge, language, clan system, and Diné Way of Life understanding. What can we do to bring back the pride of living in a world of the beauty way (*Hozho*)? There is a need for a different approach of instruction. Thus, culturally responsive instruction is an important strategy in supporting our Navajo students in their achievement of academic success. Culturally responsive schooling has been a topic of discussion between the Federal, Navajo Tribal, and State Governments. Within these discussions there has yet to be a specific policy or foundation to guide schools in defining a culturally responsive curriculum for the future of our Navajo children. So, regardless of whether schools operate on or off

the Navajo reservation, in the same way that schools are accountable to the state and federal governments, so too should they be accountable to the Navajo Nation. Today, this vision, is still not being fully acknowledged by most school systems serving our Navajo children. In most cases, schools are in the beginning stages of adjusting their curriculum to meet the needs of our Navajo youth. To address this need for my students, it is the basis of my unit to instruct an environmental science engineering issue of single use plastic using cultural relevancy to deepen the understanding of the environmental impact and in the process bridging the knowledge of our cultural heritage. If we can address environmental issues in a relevant meaningful way to our students, they will likely change some of their habits in the use of plastic in their home and maybe change their family's usage as well. They need to be aware of the environmental issues in their community as well as global issues.

## Content Objective

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A school setting is an ideal place to create awareness because it sets up a good way to get students involved in a school community and practice getting their voices heard. Students have more power in their community than they think. The unit entails encouraging students to cultivate their approach by practicing academic discussions, using science vocabulary, questioning, sharing of ideas and thoughts, using scientific explanations, analyzing evidence, and creating models using the engineering approach in finding a solution. Through discussions, students can reflect on their current beliefs and concepts and begin to develop ideas that would support their solution for this environmental issue.

In addition, the unit integrates cultural teachings, to support students in learning about their ancestral heritage and the Diné Way of Life. By including the Diné teachings, student will understand how our ancestors lived in harmony with Mother Earth. In having students learn about their cultural ways, they are more inclined to understand that they need to continue this way of life of respecting their surrounding environment and keep the balance of harmony called, "*Hozho*". Students will understand the importance of keeping harmony with Mother Earth (*Nihima Nahasdzáán*) and Father Sky (*NihizheeYádithit*) to the Diné people.

The purpose of this unit is to have my 8<sup>th</sup> grade students learn about the history of plastic, their cumulative growth in production, how it negatively affects our environment and finding solutions using problem solving to address this problem. The students will present their solution to their peers, community and tribal leaders.

This curriculum unit will integrate methodically into my 8<sup>th</sup> grade environmental science lessons, but the curriculum unit can be adjusted to accommodate other grade levels according to student needs. I plan this unit to take at least three weeks of instructional time with 55 minutes each day. The unit is align to earth and Next Generation Science Standards on the human impact on environment.

Earth/Space Science:

1. Human Interactions with the Environment – Students learn about the earth's natural resources and man's impact on the environment. Materials cover energy resources, renewable & non-renewable resources, the human impact on ecosystems, and ways we can minimize waste .<sup>3</sup>

## Rationale

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Within our Native communities, there is a growing problem of environmental issues regarding water, air, and land. As educators, we are obligated to address issues that affect people in our communities. Therefore, this unit will support my students in understanding how plastic affects not just other people's environment but their own community environment as well. I want my students to grasp the understanding that everyone needs to make changes in order to reduce the problem and to help find a solution. When students understand the importance of change, maybe they will advocate for this type of change to others in the community.

The curriculum unit focuses on the effect of single use plastic on the environment, which aligns to the Next Generation Science Standards adopted for our state. In addition, my unit will support my curriculum on environmental science, which is an important strand in the standards that applies to my students and their community. Just as anywhere else in the world our Diné tribal land is being polluted with single use plastic pollution. As I travel to different areas, of the reservation, I noticed an increased amount of plastic bags and water bottles strewn about on this vast land. I see plastic bags clinging to fences that were built to keep livestock within their grazing area. It is very sad to observe our land that is the center of our harmony and known as mother earth, become a place of plastic polluted land, which I believe is unintentional.

Knowing that plastic does not biodegrade or corrode, I thought about all the water bottles my students bring into our classroom on a daily basis. This made me realize the need in focusing on this issue to help my students understand, the impact of this problem on Mother Earth, how they contribute to the problem. As I begin this unit, I want to include the cultural aspects of taking care of mother earth and Diné way of life in relation to our environment. Our ancestral teachings is an important part of my instruction in supporting the revitalization of our Diné way of life.

Currently, I am teaching 8<sup>th</sup> grade math and science, which is an ideal setting to instruct this curriculum unit as we cover environmental science. Therefore, the purpose of this unit is to enable my students to become knowledgeable, or more knowledgeable, of the significant impact and effect these plastic materials have on the environment today and in the future. As students learn more about the issues caused by single use plastic, they can start sharing ideas on what they can do to help solve the problem.

## Content

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A world without plastics, or synthetic organic polymers, seems impossible, yet if you remember in our history the large scale production of plastic only dates back to about 60 years. One of the first type of plastic is celluloid, which was invented in the United States in 1865 to simulate tortoiseshell. It was used for combs, ornaments and other decorative items. Then in 1891, rayon was created as a cheap substitute for silk. Although the first synthetic plastics, such as Bakelite, appeared in the early 20th century, the widespread use of plastics did not start until after World War II.<sup>4</sup>

In 1907, Leo Baekeland was the inventor of Bakelite in New York. This invention began the plastic industry. It was used to make telephones, electrical sockets, costume jewelry and many other essential items. Leo

Baekeland was the first person to use the term “plastic” to describe this new type of material that could be shaped into many forms.<sup>5</sup> For more than 150 years, plastics changed human life in a positive way by providing essential goods. You use plastic every day when you brush your hair and teeth, pour juice, cook a meal, eat a meal, use a computer or cellphone, play games, wash dishes, drive a car, drink from a water bottle, wear a windbreaker, ride a bike, wear glasses, watch television and the list goes on. Look around your home or school. How many different types of plastic do you see? You will find plastics in almost everything you use. Plastics are products that can potentially, be of use for decades, and yet our main use of these lightweight, inexpensive materials are as single-use items. Single use plastic production is growing at a rate that exceeds the waste management system and thus making a negative impact on our environment.

### **Single Use Plastics**

Single use plastics are items or goods that are manufactured primarily made from fossil fuel based chemicals petrochemicals (PET). They are meant to be disposed of right after use such as water bottles, packaging, cutlery, wrappers, straws, and plastic bags. Of course, people can not imagine living without these products because we are now a throwaway culture. Instead of investing in quality goods that will last a long time, we often run to businesses that sell single use products.

The world produced more than 342 million tons of plastic in 2014, half of which is for single use products. That is approximately the same weight as 171 million cars. Americans alone use 100 billion plastic bags every year. Hence, it is estimated that the amount of plastic produced will double by 2034.<sup>6</sup>

By comparison, the growth of plastics production in the past 60 years has substantially surpassed any other manufactured material. Figure 2 is a graph that demonstrates the cumulative growth in production of plastic. It shows the production has significantly increased in the last three decades. The production of plastic is increasing because of the variety of ways plastic products are produce.<sup>7</sup> The properties that make plastics so versatile in countless applications with durability and resistance to degradation make these materials difficult to assimilate. Our reliance on these products means we are accumulating more waste at a staggering rate. Thus, without a strategic plan and tailor made management strategy to control plastics waste, humans are navigating toward a devastating environmental issue on a global scale, in which tons of material will accumulate across Mother Earth.

## Plastic Production

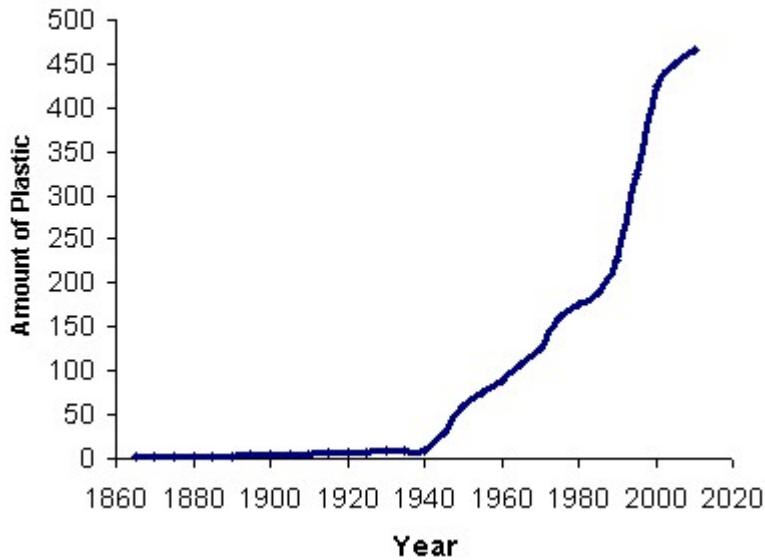


Figure 2 is a graph that illustrates the cumulative growth of Plastic Production

This accumulation of plastic is not good for Mother Earth because single use plastics are not biodegradable. So, what does it mean for something to be biodegradable? If something is biodegradable, then, given the right conditions and presence of microorganisms, fungi, or bacteria, it will eventually break down the material into its basic components and blend back in with the earth. Ideally, but not always, these substances degrade without leaving any toxins behind. Bacteria breaks down wood and paper, but they can't break down most plastics, nor can any other microorganism. Although, plastic does photo degrade when dumped in landfills, which means that sunlight breaks the plastic into tiny pieces. Plastic is so resilient that even burying it deep within the earth does not keep it from affecting the environment. Currently it accounts for approximately 10 % of generated waste, most of which is in landfills.<sup>8</sup> Thus, dumping plastics in landfills may simply be storing a problem for the future, but when not disposed of properly, plastic can fly away with the wind, causing an increase in environmental pollution. It is estimated that one-third of discarded plastic packaging is blown by the wind or washed into rivers. This plastic can clog waterways and damage ecosystems.<sup>9</sup>

### **Cultural Connection**

The perspective of Native Americans, in regard, to Mother Earth spirituality holds great potential for the environment movement as we integrate it into our curriculum. For many centuries, Native Americans have held Mother Earth on a pedestal and lived in harmony with nature. In the past Native Americans lived with the earth on a deeply spiritual basis.<sup>10</sup> They had a connection with all existence, which gave them a deep ecological wisdom that present day environmentalist have just begun to discover. For many years the Diné people have been blessed with this wisdom but we are now at a point where our Diné way of life is fading from our new generation. As a Navajo educator, I believe in integrating our cultural aspects into our curriculum to support student achievement and to keep our tradition from disappearing.

Incorporating the Diné philosophy into my lessons is a significant part of my teaching, which I will utilize in instructing my Navajo students about environmental issues such as single use plastic. Students will understand that Mother Earth (*Nihima Nahasdzáán*), Father Sky (*NihizheeYádíthií*), air (*nítch'i*), water (*tó*), land



(*kéyah*), mountains (*dził*) are all considered sacred elements that surrounds us as human beings. In this unit, we will focus on Mother Earth (*Nihima Nahasdzáán*), and how a man-made substance, plastic, is causing her distress. What can we do to help Mother Earth? Mother Earth cannot heal herself alone. She needs our help. We must all come together and form a commonality of realization, a realization of potential possibilities in finding solutions. Understanding the problem and searching for solutions will help students understand the need for change and innovations.

With the interconnected relationship between Navajos and their environment, which could support a stronger learning experience for students due to having a specific local focus rather than the universal approach as in Western sciences. Each individual Native culture, such as the Diné people create scientific systems based on their specific cultural experiences. In other words, what is true about scientific aspects of nature for the pueblo tribes is somewhat different for the Diné Nation, even though they live in the same region. This approach can be particularly valuable in diverse classrooms when discussing science and environmental impact. By addressing the specific needs of Mother Earth to our Native students through cultural aspects, students would be able to develop a connection to their surroundings that would spark a desire to protect it.



Figure 3 illustrates the environmental issue of single use plastic on the Navajo Nation.

Plastic is putting a strain on waste management systems and vulnerable communities across Mother Earth. Single use plastic products are found at the deepest depths of our rivers and the greatest heights of our mountains. There is no place on Mother Earth that is immune to plastic pollution. Figure 3 shows the environmental problem that plastic can cause. This picture shows the banks of the Colorado River on the Navajo Reservation. People like to go camping in beautiful areas but sometimes fail to clean after their outing. All of this pollution has occurred in less than a century and is causing problems for our environment and the ecosystem on our Navajo Nation.

This environmental issue also causes problems for animals as they forage for food. Litter can end up in the stomachs of goats, sheep, cows and other livestock, leaving them unable to digest their food, which can be fatal. Dead livestock and wild animals, even birds have been found to have plastic in their abdomen after eating litter left behind or strewn about. When plastic gets down an animal's gastric system and gets stuck, the animal can't digest nutrition they eat due to the amount of plastic in their body, which causes them to eventually die.

### **Navajo Nation Ban on Single Use Plastic**

The Navajo Nation and several other tribes are becoming aware of this environmental issue. They are in the process of strategizing plans to reduce the single use plastics on tribal land using federal and state laws. Federal preemption of state law, and case law restricting state infringement on internal tribal affairs, limit states' regulatory authority over Indian country except under Public Law 83-280 of 1953, which was enacted during the Termination Era. This law granted to six states, as a criminal and civil jurisdiction over Indian country. Originally, states could take partial jurisdiction without tribal consent but the U.S. Supreme Court later clarified that P.L. 280's grant of civil jurisdiction was restricted to civil causes of action and did not extend to the full capacity of civil regulatory powers, which tribes retained. These regulatory powers include regulation of plastics.<sup>11</sup>

Under this doctrine, and prior to its 2016 reinterpretation of the Clean Water Act's, treatment as a state (TAS) provision authorizing tribes to establish their own water quality standards, the U.S. Environmental Protection Agency (EPA) confirmed that, due to the close connection between water quality and tribal health and wellbeing, tribes' maintained authority over their reservations. Waste management arguably also falls within this framework. Courts have supported the right of tribes to tax non-members. In states where local regulation of single-use plastics is prohibited, a small but growing number of tribes are using their sovereignty and adopting bans on single-use plastics. For instance, the Navajo Nation, which governs the largest reservation in the United States, is in the process of enacting the Single-Use Bag Act, a 2015 bill that would prohibit retailers from supplying plastic bags. This bill is still in the process but for now is under public review first. In addition, the Navajo Nation Environmental Protection Agency (NNEPA) intends to incorporate core fundamental concepts of Diné culture and philosophy pertaining to environmental stewardship or protector.<sup>12</sup>

Of course, there is no easy answer. Plastics fulfill so many useful functions that it would be impossible to get rid of them completely. We probably wouldn't even if we could because it is a money making industry. The industry also provides jobs for many people across the United State. But, something must be done to prevent the increasing amount of plastics that get thrown away and end up in our landfills and ecosystems.

### **Possible Solutions to Single Use Plastic Problem**

It will take the effort of people around the world working together to make a positive impact on this environmental issue of single use plastic. Some suggestions on how people can get involved with this effort for a sustainable future include 1) Increase the amount of plastics that get recycled. 2) Avoid using single use plastic if possible. 3) Ban single use plastics. 4) Innovate new plastics that decompose (Biomimicry) .<sup>13</sup>

#### ***Recycle***

The most common solution in addressing this environmental issue is to recycle. Many types of plastic can be recycled. In 1988, the Society of the Plastics Industry came up with numbered codes (1 to 7 inside a triangle of arrows) to help the manufacturers and consumers identify the type of plastic. The most commonly recycled



plastic is number 1, polyethylene terephthalate or PET, which is used for water and soda bottles. It can be recycled into other products such as sleeping bags, furniture or more water bottles. There are cities that recycle only numbers 1 and 2, but these make up nearly 96% of all the plastic bottles and containers used in the United States. According to the EPA, Americans recycled only about 15% of plastic containers and packaging in 2014. This is less than the recycling rate of 72% for aluminum cans, 89% of corrugated cardboard and 99% of lead-acid batteries. In addition, just because a plastic has a number on it does not mean it *can* be recycled. Not all types of plastic are recycled in all communities and not all of the products made from recycled plastic can be recycled themselves. Therefore, the plastic ends up being thrown away, adding to landfills and damaging ecosystems.<sup>14</sup>

### ***Avoid Single Use Plastic***

Avoiding the use of single use plastic will help support the effort in reducing the plastic waste issue. There are several ways a person can implement this strategy by using a reusable water container, reusable tote bag when shopping, and reusable coffee mug. You can ask vendors to give you a paper bag if possible. Other suggestions include: 1) Cook more often at home to reduce using take out containers and cutlery. 2) Buy items in large bulk and avoid individually packaged products. 3) Buy items in person rather than online to alleviate plastic packing for shipments. 4) Use reusable containers for leftovers instead of plastic baggies or plastic wrap. 5) Ask for an alternative straw rather than plastic and if they don't have one, drink out of the cup or glass. If everyone puts effort in avoiding the use of single use plastic, it is possible to slow down the plastic waste problem.<sup>15</sup>

### ***Ban Single Use Plastic***

There are many cities across the United States that are on board in banning single use plastic. In New Mexico only the larger cities such as Albuquerque, Santa Fe and Las Cruces have put this ban law into place. Once ban laws are enacted in all cities and even statewide, the use of single use plastic bags will decrease. This will prevent millions of tons of plastic from entering the waste stream each year and slow the growth of plastic waste on Mother Earth.

### ***Biomimicry***

One method that is used to address real world problems is Biomimicry. The goal of biomimicry is to create innovative products, processes, and policies to solve the world's greatest design challenges sustainably and in harmony with life on Mother Earth. We can use biomimicry to not only learn from nature's wisdom, but also to heal Mother Earth in the process. This method is used for creating solutions to human and environmental challenges by imitating designs and ideas that are found in nature.

One example is the biodegradable plastic like material called Shrilk. This material, developed by Javier Fernandez and a team of others at Harvard University using chitin extracted from discarded shrimp shells. The material has strength, toughness and versatility. Shrilk can be produced very cheaply and can be used for consumer products and healthcare applications. The exciting thing about this product is that it is made from nature and is biodegradable. It has the potential to reduce the dependence on single use plastic and is better for the environment.<sup>16</sup>

## Teaching Strategies

The lessons within the curriculum unit will have students analyzing data charts, reading articles, researching, sharing ideas, demonstrating models, strategy mapping, utilizing the engineering methods of finding solutions. This unit will stress the importance of discourse and sharing ideas in a cooperative learning environment. This is important for students because they need to practice constructing meaning of science concepts through discussion and demonstrating their ideas based on their learning and understanding. In addition, the cooperative learning strategy supports student learning in an organized and structured way and enhance interdependence. Students will be given each task or assignment, which they will work on together to complete (a suggested rubric to assessment cooperative learning is below figure 4). They will have opportunities to present explanations of what they learned, combined with data or evidence to demonstrate their learning. They will present their findings to their peers for feedback and revise or add their presentations before they present their findings to either parents, community or tribal officials.

SCORE	1	2	3	4
Participation	I did not participate in the activity	I occasionally participate in the activity	I frequently participate in the activity	I always participate in the activity
Discussion	I do not participate in the group discussion	I occasionally participate in the group discussion	I frequently participate in the group discussion	I always participate in the group discussion
Group Role	I do not take my group role seriously	I occasionally take my group role seriously	I frequently take my group role seriously	I always take my group role seriously
Teamwork	I do not play a part in teamwork	I occasionally play a part in teamwork	I frequently play a part in teamwork	I always play a part in teamwork
Academic Language	I do not use complete sentences or academic language in my class work and discussions.	I sometimes use academic language but do not express complete thoughts in my class work and discussions	I often use academic language in class and use complete sentences in my class work and during group discussions.	I always use academic language and complete sentences in my classroom work and group discussions.

Figure 4 is a Self-Evaluation rubric for students in Cooperative Learning

### Essential Questions?

1. What are single use plastics and why do people frequently use them?
2. How does the single use plastic items effect the environment?
3. What can we do to help reduce this environmental issue?
4. Does knowing your heritage motivate you to be more aware of environmental issues?
5. How can you apply biomimicry to address this environmental issue?

### Objectives

- Students will analyze the history of plastics, their effects on the environment and efforts to address those effects.

- Students will evaluate the role of single use plastics in their lives and reflect on their willingness to change their behaviors to help reduce the pollution
- Students will share ideas and collaboratively find solutions using problem-solving skills.
- Students will present their findings to their Native community to advocate for change in supporting Mother Earth (*Nihima Nahasdzáán*),

Another strategy incorporated into the unit is environmental engineering. What is environmental engineering? The condensed definition in this unit is the application of science and engineering knowledge and concepts to care for and/or restore our natural environment and/or solve environmental problems. This approach guides us as we begin to understand the depth of environmental issue and using that knowledge toward an appropriate preventive measure. Environmental Engineers around the world are certainly trying to solve this problem by designing innovative mechanisms to protect the environment. Therefore, the first step in this approach is to research information, learn about the problem, understand the consequences if there is no prevention. Then use the information gathered to find solutions or preventions to eliminate or slow the process of the environmental problem.

Teacher's Note: In using the strategy of cooperative group activities, it is important to discuss how teams need to work together to accomplish their task in a set time. They may choose to assume different roles suited for the group task, for instance, a leader, recorder, timekeeper, etc.

### **Learning Activities:**

Guided learning activity-Show student items you have collected that contain plastic. Have students brainstorm other items that are made from plastic. List these items on the board. Have students make two columns, title one-side benefits and the other side title it negative impact. Then have students work with a partner to list what they already know about the benefits of these items made of plastic. Next, have them write the negative impacts after doing some quick research on their class tablet or computer. With a partner, have students record their initial thoughts about the negative impacts. Which column on their sheet had more listed? What stands out? After they record their answers, the students will discuss their finding as a class. Explain to the class that over the next few weeks, they will be designing a solution to the negative impact of single use plastics.

Reading and Researching Activity- Students will be expected to read books, articles and other material from the internet or in libraries to enhance their understanding of single use plastic pollution. These reading strategies are important for students to master as they move higher in grade level. Students will spend time:

- Looking for information
- Selecting information
- Noting and recording information
- Interpreting information
- Organizing information
- Referring to information in assignments

Analyze Data Activity- Students will analyze data from the research of their choice. Data analysis is the process of interpreting the meaning of the data students have collected. Data study is a valuable tool for students to learn, especially considering that so much data is now being generated. This is an important learning experience for students as they prepare for High School level math and science courses.

Infographic Activity- Infographics are graphic visual representations of information, data, or knowledge intended to present information quickly and clearly. Students will organize a collection of data they feel is important to represent what they learned in their analysis by displaying it in the form of a table, bar chart, line graph, or other representation. By completing this type of assignment my students will improve reasoning by utilizing graphics to enhance the human visual system's ability to see patterns and trends. A science board or large poster board with the data analysis report are some examples of infographics. As long as the group of students work together to share their understanding of the environmental issue.

1) Tell students that based on what they learned, they will create infographics that illustrates a problem with single use plastics on the environment. The student will focus in on one specific problem that single-use plastic may cause on the environment on the Navajo Nation or in their community environment. What issues do they see?

2) Students will also become photographers of their community by taking pictures of single use plastic pollutions wherever they encounter the problem. They will use this as part of their infographic data collection and their presentations.

Show an example of an infographic from the internet. Ask students, where they have seen an infographic? Maybe articles, newspaper, advertisement, textbooks, etc. Students will use the information they gathered to create an infographic using the following criteria: 1) title 2) at least four pieces of evidence 3) use images or data more than text 4) citation of where they gathered the information. They will post their finished product in the school hallway. (A suggested rubric is included in figure 5)

Infographic Rubric (example)	minimal	moderate	achieve
Has an appropriate title	1	2	3
Contains at four pieces of evidence	1	2	3
Organization of the project	1	2	3
Data shares focused information	1	2	3
All citations are included	1	2	3
Total points possible 15			

Figure 5 is a suggested simple rubric

Engineering Problem Solving Activity- When engineers set out to solve a real world problem they go through an engineering problem solving process. In this activity, students will work in a group to learn how to conduct the steps of the engineering process of problem solving. The first step is to have students do research, then, identify the specific problem. In this first step, students can bring pictures, interview people, and collect information from their family to help them identify the specific problem. They may ask questions such as "What do you do with your plastic bottles when you drinking the soda or water?" or "What do you do with the plastic bags that you bring groceries in?" Remind students they have to be specific questions and to keep track of their data. Once students agree on the specific problem they will address, they will come with a problem statement. A good problem statement is concise in describing the issue in which they will solve. Students will then identify what constraints they will encounter as they find a solution. These constraints are going to be from their school or community environment, which could include school or reservation policies regarding land, people and funding. They will need to include these constraints in the process. The next step

is for students to brainstorm possible solutions and list them on a large poster paper. Then the students in their own group will discuss the options and choose the most promising. They will then draw out a proposal or a narrative of the possible solution to the specific problem. The solution should be specific in addressing the solution. The students in the group will present their solution to their peers. Their peers will ask questions and give feedback on the presentation. The students will use the feedback provided by their peers to revise, enhance or create a new solution. This process will continue until students are satisfied with their solution.

The culminating project for this unit is to have students gather all their learning activities and present it in a narrated/captioned slideshow or video about their ideas and solution. They will use this to present to other classrooms, teachers, parents, community or tribal officials. This culminating activity will be used to assess student understanding.

### **Student Resource Sites:**

<http://www.howstuffworks.com/search.php?terms=plastics> - This site has information on different types of plastic, the history of plastic production and current issues of plastic.

<http://www.howstuffworks.com/search.php?terms=recycling> - This site has information on ways people can address and find solution on plastic pollution.

<https://blog.epa.gov/2016/11/01/confronting-plastic-pollution-one-bag-at-a-time/> - This site informs people of the impact of single use plastics on earth.

<https://blog.recyclecoach.com/blog/single-use-plastics-the-impact-and-possible-solutions> - This site is informative for finding possible solutions

<https://blog.epa.gov/tag/plastic-bags/> - This site has information on single use plastics

<https://www.fastcompany.com/3060571/10-clever-student-inventions-that-could-reduce-our-waste>

<https://www.grandcanyontrust.org/native-entrepreneur-turns-rez-trash-problem-golden-opportunity> - This site is titled, "Native Entrepreneur Turns Rez Trash Problem into Golden Opportunity"

### Classroom Materials

- Pencil, Notebook, Markers, Poster Paper, Colored Post-its
- Clip art
- Plastic products (single use items)
- Magazines, articles, newspaper
- Tablet and Internet Access
- Planning Sheets
- Excel program
- Publisher program
- Printer to print data
- Activity sheets and/or templates



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## Appendix A

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### Next Generation Science Standard

The performance expectations in Middle School - Human Impacts help students formulate answers to the questions: "How do human activities affect Earth systems?" Two sub-ideas from the NRC Framework are addressed in these performance expectations: ESS3.B and ESS3.C. Students understand the ways that human activities impacts Earth's other systems. Students can use many different practices to understand the significant and complex issues surrounding human uses of land, energy, mineral, and water resources and the resulting impacts of their development. The crosscutting concepts of patterns; cause and effect; and interdependence of science, engineering, and technology are called out as organizing concepts for these disciplinary core ideas.

7-8 Dine Cultural Standards are included to support the cultural aspects of learning the focused area of

environmental science in this unit. The standards are Concept 1 Standard – (*K'e doo nitsahakees doo nahat a naasgoo iina bee siih hasingo adoolniil*) – I will develop an understanding of Dine way of life. Concept 2 Standard – (*Nahasdzaan doo Yadilhil baa hane doo bina nitin choosh ii dooleel*) – I will practice my cultural teachings of earth and sky.

Concept 4 Standard – (*Iina bina'niltin bits'aadoo ya'at'eehgo she 'ina' adeeshliil*) –

I will live by the fundamental standards of living in harmony

## Endnotes

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- <sup>15</sup> “Plastics: Material-Specific Data.” EPA. Environmental Protection Agency, October 30, 2019. <https://www.epa.gov/facts-and-figures-about-materials-waste-and-recycling/plastics-material-specific-data>.

<sup>16</sup> “Bioplastics.” Wyss Institute, July 14, 2020 <https://wyss.harvard.edu/technology/bioplastic/>.

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