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## **The Value of Recycling on Water Conservation**

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# The Value of Recycling on Water Conservation

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## Abstract

Sandia National Laboratories (SNL) is working to conserve water through recycling. This report will focus on the water conservation that has been accumulated through the recycling of paper, ceiling tiles, compost, and plastic. It will be discussed the use of water in the process of manufacturing these materials and the amount of water that is used. The way that water is conserved will be reviewed. From the stand point of SNL it will be discussed the amount of material that has been accumulated from 2010 to the first two quarters of 2013 and how much water this material has saved.



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## **NOMENCLATURE**

SNL      Sandia National Laboratories

## 1. INTRODUCTION

Recycling is the process of gathering used material and treating them to be reused or recycled into different or the same material. The concept of recovering materials has become popular in previous decades and is important to the protection of Earth. This allows protection to the scarce resources on Earth like precious metals and elements. Greenhouse gases also are a large portion of manufacturing if less processing or less hours of manufacturing are needed this will limit the release of these harmful gases. Recycling is part of water conservation. Water conservation is the act of saving water through consuming less water and being aware of where it is used and how it is used. Conserving water will permit the Earth's present water supply to last longer than if used irresponsibly. Recycling promotes water conservation because by restoring and reprocessing goods, less water is needed in the manufacturing of various materials.

Sandia National Laboratories (SNL) does their share to start on the path of becoming a zero waste to the landfill facility. SNL does many different things to help the community become aware and participate in recycling. They encourage recycling in offices and buildings as well as in departments where other materials can be recycled such as concrete. SNL has recycled around 180 different types of material and about 130,845 metric tons in the years of 2010 through the beginning of 2013. Categories of materials that are recycled at SNL that will be focused on in this report are paper, ceiling tiles, compost, and plastic.

## 2. PAPER

Paper is used in everyday life; for school, in the media, at work, and at home. All these uses of paper total up to 78,498 tons<sup>[14]</sup> in 2012 in the United States. The benefits of recycling paper are enormous. By recycling paper first landfill space is reduced, second trees are saved, and third water is saved. This amount of paper equates to 28 percent<sup>[4]</sup> of the total tonnage in landfills in the United States. The space saved in landfills in 2012 based on the number of tons recycled was approximately 168,604 cubic yards<sup>[2][14]</sup> Cerro Colorado landfill in Albuquerque, New Mexico is currently 24,161,000 cubic yards.<sup>[12]</sup> On average based on the type of paper made it takes about 20 trees to make one metric ton of paper<sup>[4]</sup>. By recycling one ton of paper, which is not very hard considering the amount of paper we use on a daily basis, we save 13 trees<sup>[4]</sup>. These trees on the other hand consume carbon dioxide from the atmosphere, and produce more oxygen which is good for human wellbeing. These trees are beneficiaries of the extra water that is saved when paper is recycled. Pulping of wood and other processes for getting the fibers to make paper can use anywhere from 13,920 to 26,400 gallons of water per metric ton.<sup>[15]</sup> Unbleached paper like cardboard uses less water than bleached paper like printing paper. Recycling paper saves up to seven thousand gallons of water per metric ton. This water is saved because less water is needed to pulp paper than to pulp wood.

SNL has saved landfill space by keeping paper out of landfills and also conserved water by recycling. Between the years of 2010 and the beginning half of 2013 SNL recycled 1,739.5 metric tons of paper equating to as much as 12,176,500<sup>[2]</sup> gallons of water preserved. This can be compared to the 35,068,320 gallons of water<sup>[15]</sup>

on average this paper would have taken to produce, that is a big saving. SNL sends their recycled mixed paper to local vendors. Cardboard can be sent to a mill located in Pruitt, New Mexico or to Mexico. The location that it is sent to is determined on demand and the collected amount by the vendor. SNL sends white paper directly to a mill in Michigan. The paper that is sent to this mill is probably made into lower grade paper. The great thing about paper is it can be recycled multiple times and each time it does not have to be made into the same type of paper or not even paper at all. For example, masking tape, bandages, dust masks, and hospital gowns can all be made from recycled paper.

### 3. CEILING TILES

Ceiling tiles are found in the majority of office buildings. Ceiling tiles are easy to install and are used primarily to hide electrical wiring and air ducts from plain sight. They keep the sound from traveling to other offices. In 2011 Armstrong Corporation sold almost 350 million ceiling tiles from their factories around the world.<sup>[11][19]</sup>



Ceiling tile production is like that of paper, including a pulping

process to get the correct mixture to be molded and cut. Water is used to produce ceiling tiles by processing the raw material before they enter the slurry to be molded into ceiling tiles.<sup>[11]</sup> The slurry contains water. One metric ton of ceiling tiles takes approximately 5,600 gallons of water to produce.<sup>[11]</sup> Armstrong is known for using recycled material in new products. Ceiling tiles from Armstrong can contain different percentages of recycled material, which saves water. Recycling one metric ton of ceiling tiles can save roughly 1,892 gallons of water.<sup>[1]</sup> Water is saved because with recycled materials the water that would be used to process raw materials is saved.

SNL works with Armstrong to reduce the impact of ceiling tiles on landfills. This is done two ways; SNL sends their used ceiling tiles to be recycled, and purchases back ceiling tiles that contain recycled material. From 2010 through the present day SNL has recycled 63.4 metric tons of ceiling tiles. The ceiling tile that SNL has recycled has saved around 119,953 gallons of water. Making this amount of ceiling tiles from raw

materials would have used 355,040 gallons of water. The good thing about recycling ceiling tiles is they can be recycled multiple times and can save an abundant amount of water in the process.

## 4. COMPOST

United States landfills are made up of 30% organic material that could have been composted.<sup>[7]</sup> Compost has many functions the primary functions are that of improving nutrient content of the soil and conserve water. An average residential landscape with grass, trees and bushes in the United States can go through 10,000 gallons of water a year.<sup>[5]</sup> This is a lot of water for the threatened amount of water that there is in the country. Compost can hold more water because of its absorbent due to the spongy



texture caused by the decomposing of the organic materials. The moisture content of that is recommended for compost is between forty and sixty percent by weight.<sup>[6]</sup> This moisture content allows the decomposing of the organic material to take place steadily. One metric ton of compost would contain about 145 gallons of moisture.<sup>[20]</sup> All the moisture in the compost is not pure water, but it can come from the food or green waste that is within the compost also. SNL contracts with a local composting company in order for the food waste that is generated at the two

cafeterias on the SNL campus to be picked up by. Between the years of 2010 and 2013 SNL contributed about 58.6 metric tons of food waste from these two locations. SNL also collects green waste such as landscape debris. This material goes to Albuquerque Bernalillo County Water Utility Authority Soils Amendment Facility for composting. This facility has received 653 metric tons of green waste and pulverized paper from SNL among the years of 2010 and 2013. In exchange for the feedstock material,

Albuquerque Bernalillo County Water Utility Authority Soils Amendment Facility periodically provides a load of finished compost to SNL, so they can conserve water with their landscapes. Compost's ability to retain larger amounts of water and reduce runoff can save fifty percent<sup>[21]</sup> of the water used if compost was not present. SNL has conserved about 21,300 gallons of water in the compostable material that they have collected. This number is for a one time use so the savings are much greater because one application of compost can last a lengthy amount of time. If compost was not used the water amount that would be used is approximately 42,500 gallons.<sup>[23]</sup> So, over the lifetime of the compost (March- November) if you "Water by the Numbers,"<sup>[23]</sup> the combined 711 metric tons compost has saved about 1,759,600 gallons of water. The water saving only improves with each application because soil becomes more nutrient rich and more absorbent.

## 5. PLASTIC

In 2011, the rate at which plastic recycled national as a whole was only eight percent.<sup>[17]</sup> Plastic like paper is used in everyday life and can be found everywhere. Water is used in the manufacturing of plastic as a cooling process and as a lubricant to make the removal of plastic out of molding easier.<sup>[16]</sup> It may seem like only a small application of water is needed, but for every metric ton of plastic made a total of 145,700 gallons of water are used.<sup>[24]</sup> By recycling one metric ton of plastic you can



save 6,000 gallons of water.<sup>[13][22]</sup>

This water is saved because by eliminating the extraction and refinement of the raw materials.

Recycling plastic is important because plastic does not start breaking down for 700 years.<sup>[9]</sup>

This means that plastic takes up a lot of space in landfill because every day the world uses 100 million plastic bottles.<sup>[9]</sup>

With the SNL campus having so many offices, plastic containers are common. SNL offers plastic recycling bins in all occupied buildings for #1 and #2 plastic bottles. The Pollution Prevention team will also support recycling of abnormal plastics upon request. SNL has recycled 56 metric tons of #1 and #2 plastic bottles. This recycled material conserved approximately 336,000 gallons of water. The water that would have been used is about 8,157,400 gallons to make this amount of plastic from raw material.

SNL has also saved 414.4 cubic yards of landfill space with their efforts to prevent plastic waste.

## **6. CONCLUSION**

Recycling has become an important to the well-being of the Earth. Goods that people use on a daily basis come from raw materials that are running out. Future occupancy of Earth depends on the sustainability of materials and the conservation of these materials. Neither humans nor animals will survive on Earth if it is covered in trash. By recycling today and diverting useful material from landfills we are preventing the landfill build up. Recycling also conserves water as we have seen in this report that every little bit helps save water. The four materials discussed from SNL have helped conserve 14,400,353 gallons of water.



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