



### The Salty Seas



About 71% of planet Earth is covered with water. Most of that water (almost 98%) is found in the oceans and seas as **seawater**, which is salt water. **Salt water** contains salt and other minerals that give it a salty flavor. While sea creatures like fish, squid and whales can drink salt water and survive, human beings and most other land animals cannot. We can only drink freshwater, which makes up less than 3% of all water on Earth. **Freshwater** is not salty, and is found in rivers, lakes, snowy mountain ranges, glaciers, and underground in **aquifers**. Much of that freshwater is unavailable for us to use because it's frozen in icy glaciers or it's too deep underground. That means we can only use less than 0.34% of all the water on Earth. That's like having 100 dollars but only being able to spend 34 cents!

### Water is Life



Along with clean air, freshwater is the most precious resource in the world! That's because all people (and most animals and plants) need it to survive, no matter where we live. Freshwater can be hard to find in dry places like deserts, or during periods of **drought** when very little rain or snow falls in an area. Because of this, some people get

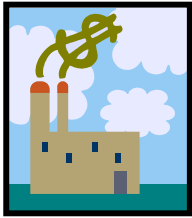
their drinking water by removing salt from seawater. Countries like Australia, Saudi Arabia and Israel make drinking water or **potable water** from salt water. So do ships and submarines, which are out at sea for long periods of time. "Sal" is a Latin word meaning "salt." "De" means to remove. Therefore, to **desalinate** salt water means to remove salt and other minerals in order to make potable water, which we can use for drinking, cooking and other uses.

### Removing the Salt



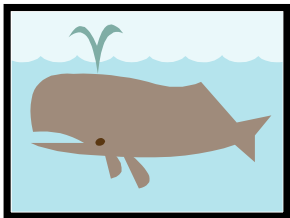
There are a few different methods or ways to desalinate water. One way is **distillation**. That means bringing salt water to a low boil and capturing the steam that is created through **evaporation**. The steam gets collected as pure water, without any salt or minerals. Another method—that is common today—is called **reverse osmosis**. This uses **membranes**, or large screens with tiny, tiny holes. The screens' holes are so small that the salt and minerals found in seawater cannot pass through them. Water, though, can pass through the membrane with the help of high pressure, which is like a BIG push. This leaves the salts and minerals on the other side of the filter. As a result, almost pure water collects on one side of the membrane, and all the stuff that got filtered out—a very salty liquid mixture called **brine**, stays on the other side.

### Sounds Easy, Doesn't It?



Although desalination sounds easy, it is difficult for several reasons. First, in order to desalinate enough water to supply people with freshwater, a **desalination plant** needs to be built, usually near a large body of water. Then, a lot of energy is needed to power the plant. To do all of this is very expensive! Desalination plants also need to be properly designed to protect our environment. The future of marine life and coastal beauty need to be considered before building a desalination plant.

### What About the Brine?



Another problem with desalination is that it makes a lot of very salty brine. This brine is a by-product or leftover that is created from the desalination process. While it's possible to turn brine into table salt we can eat, it's usually too expensive to do that. Instead, brine is **discharged** or returned back to the ocean from where it came. Since brine is so salty or **concentrated** with salt and minerals, it's very important to **dilute** or add water to the brine so it's less salty. If an ocean gets too much salt all at once, it can harm the marine life in that area.

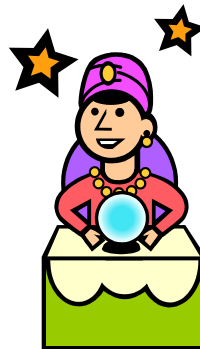
### Desalination in San Francisco



San Francisco enjoys some of the finest freshwater in the world, thanks to the Hetch Hetchy Reservoir in Yosemite Valley 167 miles away.

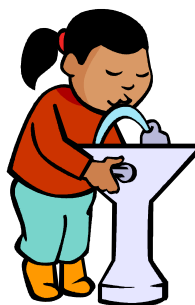
However, San Francisco and the rest of California often go through periods of drought when rain and snow fall less than normal. After 2-3 years of low rainfall, water sources dry up and we have less freshwater available to use. The San Francisco Bay Area is close to several bodies of water. That's why the region is in a unique position to build a desalination plant nearby, which could provide the Bay Area with another reliable source of a potable water supply.

### Looking to the Future



As water supplies are limited during periods of drought, and more people move to the San Francisco Bay Area, the region will need more water. The City of San Francisco is working with its neighbors in the Bay Area to see if it is a good idea to build a desalination plant that can be shared especially during droughts and emergencies. If so, it could produce up to 10-50 million gallons of water per day!

### It's One Solution



Desalination is a creative solution that can help provide more freshwater to people. In addition to conservation and water recycling, it is part of the way we are thinking about how to meet our water needs in the future. Scientists and engineers are working to invent better, cheaper and more energy efficient ways to desalinate seawater, which is a good thing for all of us!



# Desalination

## Student Comprehension Questions

1. What is freshwater and where can it be found?

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2. What percentage of all the water on Earth is available as freshwater for us to use?

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3. What is desalination?

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3. What must be considered before building a desalination plant?

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4. What is brine and why is it important to dilute it before returning it to the sea or ocean?

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5. Why would building a desalination plant in the San Francisco Bay Area be helpful?

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6. What is the most interesting thing you have learned about desalination?



## Desalination

## Student Comprehension Questions

1. What is freshwater and where can it be found?

*Freshwater is not salty and is found in rivers, lakes, snowy mountain ranges, glaciers, and underground in aquifers.*

2. What percentage of all the water on Earth is available as freshwater for us to use?

*0.34%*

3. What is desalination?

*Desalination means to remove salt and other minerals from salt water or seawater, in order to make potable water which we can use for drinking, cooking and other uses.*

3. What must be considered before building a desalination plant?

*The future of marine life and coastal beauty must be considered before building a desalination plant. They need to be properly designed to protect our environment.*

4. What is brine and why is it important to dilute it before returning it to the sea or ocean?

*Brine is a by-product or leftover that is created from the desalination process. It is very salty and concentrated with minerals and must be diluted so it doesn't harm marine life.*

5. Why would building a desalination plant in the San Francisco Bay Area be helpful?

*Since California is a dry state that often goes through periods of drought, building a desalination plant in the Bay Area could provide a reliable source of potable water.*

6. What is the most interesting thing you have learned about desalination?

*(subjective answer)*