STO-174

Mysterious Case of Brain Illness

Teacher Information

science take·out
just add students™

Summary

Doctors, environmental investigators, and veterinarians work together to identify the cause of an outbreak of encephalitis (a brain illness). What actions could prevent future outbreaks and protect the health of people, animals, and the environment?

Core Concepts

- Mosquito-borne viruses pose a growing risk to human and animal health.
- Mosquito control may reduce human health risks.
- Climate change may affect virus-carrying mosquito populations and the health of humans.
- A One Health approach identifies and seeks solutions to problems that affect the health of humans, animals, and the environment.

Time Required

2-3 forty-minute class periods

Kit Contains

- **Virus Test Instructions**
- **Known RNA Sequences from Four Viruses Carried by Mosquitoes**
- **West Nile Virus Facts**
- Virus Test Sheet (simulated)
- Patient 1 Blood Plasma (simulated)
- Small dropper

Teacher Provides

- Access to internet

Warning: Choking Hazard

This Science Take-Out kit contains small parts. Do not allow children under the age of seven to have access to any kit components

Teacher Resources

- This lesson is based on an actual outbreak of West Nile Virus in New York City.

  The Outbreak of West Nile Virus Infection in the New York City Area in 1999
  https://www.nejm.org/doi/full/10.1056/NEJM200106143442401

  An outbreak of West Nile virus in a New York City captive wildlife population
  https://www.ncbi.nlm.nih.gov/pubmed/12363067

- **One Health: From Concept to Action** (video used in optional Part 5)
  https://www.youtube.com/watch?app=desktop&v=TG0pduAYESA

- **Centers for Disease Control and Prevention (CDC) – One Health**
  https://www.cdc.gov/onehealth/index.html

- **Centers for Disease Control and Prevention (CDC) – West Nile Virus**
  https://www.cdc.gov/westnile/index.html

- **Centers for Disease Control and Prevention (CDC) – Mosquito Life Cycle**
  https://www.cdc.gov/westnile/resources/pdfs/FS_MosquitoLifeCycle-508.pdf

- **Centers for Disease Control and Prevention (CDC) – Mosquito Control**
  https://www.cdc.gov/westnile/vectorcontrol/index.html

- **CDC/ArboNet – West Nile Virus: Historic Data (1999-2002)**
  https://www.cdc.gov/westnile/statsmaps/historic-data.html

Teacher Suggestions

- Internationally, there is a growing focus on utilizing One Health approaches to solve problems that involve the health of humans, animals, and the environment. One Health problems are complex and solutions to these problems require the collaboration of people from a variety of disciplines. It is important that students are exposed to this type of interdisciplinary and collaborative thinking.

- The West Nile virus is a One Health problem that involves the health of humans, animals, and the environment. An optional **Part 5** on the following two pages helps students understand what One Health means and see the importance of taking a One Health approach to solving the problem of the West Nile virus. Students will need access to the internet to view this YouTube video: https://www.youtube.com/watch?app=desktop&v=TG0pduAYESA

- You may want to ask students to brainstorm examples of other One Health problems and explain how the One Health approach may involve a collaboration of people who have careers in human health, environmental health, and animal health.

Part 5: One Health and the West Nile virus

One Health

The State Health Department is suggesting that local governments should take a collaborative One Health approach to solving complex local problems, such as the West Nile Virus. A One Health approach uses the idea that complex problems often involve the health of people, animals, and the environment. Therefore, solutions to One Health problems must be designed to protect the health of people, animals, and the environment.

1. Use the information in the text box above to explain what must be involved in a complex problem for it to be considered a One Health problem.

_____

_____

2. Watch this video from the CDC (Centers for Disease Control). The video provides a brief introduction to One Health and why it is important for public health professionals, veterinarians, ecologists, and environmental health professionals to work together.

Scan this QR code with your smartphone or tablet camera app to link to the video.

3. State one interesting or important thing that you learned about One Health from watching the video.

_____

_____

To support adoption of a One Health approach, the health department officials want to create a series of slides to provide examples of One Health problems in the community. Your team has been hired to create three slides to answer the question, **"Why is the West Nile virus a One Health problem?"**

Remember how the CDC video used images with captions (short descriptions) to help people understand what One Health problems and solutions involve. Using pictures and captions in your slides will help people understand and remember what the One Health approach involves.

2. Use the information in the text box above, what you learned from the video, and what you learned about the West Nile virus and mosquito-borne diseases to develop three slides that show why the West Nile Virus is a One Health problem. You should create three slides:

   - Slide 1: A picture (or pictures) and a caption to explain how **animals** are involved in the problem.
   - Slide 2: A picture (or pictures) and a caption to explain how **humans** are involved in the problem.
   - Slide 3: A picture (or pictures) and a caption to explain how **the environment** is involved in the problem.

Reusing the Kit

Teachers will need to instruct students on how to handle cleanup and return of the reusable kit materials. For example, teachers might provide the following information for students:

Discard	Return to kit bag
• Used **Virus Test Sheet**	• **Virus Test Instructions** • Tube of **Patient 1 Blood Plasma** • Small dropper

Refills for **Mysterious Case of Brain Illness** kits are available at www.sciencetakeout.com. The **10 Kit Refill Pack** includes the following materials:

- 10 Virus Test Sheets (simulated)
- 10 mL Patient 1 Blood Sample (simulated)
- 10 copies of **Known RNA Sequences from Four Viruses Carried by Mosquitoes**
- Transfer pipet

NGSS Correlation

Working Towards Performance Expectations

MS-LS2-2. Construct an explanation that predicts patterns of interactions among organisms across multiple ecosystems. [Clarification Statement: Emphasis is on predicting consistent patterns of interactions in different ecosystems in terms of the relationships among and between organisms and abiotic components of ecosystems. Examples of types of interactions could include competitive, predatory, and mutually beneficial.]

HS-LS2-6. Evaluate the claims, evidence, and reasoning that the complex interactions in ecosystems maintain relatively consistent numbers and types of organisms in stable conditions, but changing conditions may result in a new ecosystem.

Science and Engineering Practices

Constructing Explanations

Construct an explanation that includes qualitative or quantitative relationships between variables that predict phenomena.

Disciplinary Core Ideas

LS2.A: Interdependent Relationships in Ecosystems

Predatory interactions may reduce the number of organisms or eliminate whole populations of organisms. Mutually beneficial interactions, in contrast, may become so interdependent that each organism requires the other for survival. Although the species involved in these competitive, predatory, and mutually beneficial interactions vary across ecosystems, the patterns of interactions of organisms with their environments, both living and nonliving, are shared.

LS2.C: Ecosystem Dynamics, Functioning, and Resilience

A complex set of interactions within an ecosystem can keep its numbers and types of organisms relatively constant over long periods of time under stable conditions. If a modest biological or physical disturbance to an ecosystem occurs, it may return to its more or less original status (i.e., the ecosystem is resilient), as opposed to becoming a very different ecosystem. Extreme fluctuations in conditions or the size of any population, however, can challenge the functioning of ecosystems in terms of resources and habitat availability.

Cross Cutting Concepts

Patterns

Patterns can be used to identify cause and effect relationships.

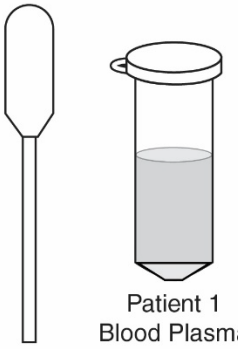
Stability and Change

Much of science deals with constructing explanations of how things change and how they remain stable.

Cause and Effect

Cause and effect relationships may be used to predict phenomena in natural or designed systems.

Kit Contents Quick Guide



Patient 1
Blood Plasma

Virus Test Sheet

The area inside each circle is coated with **antigens** from a different virus

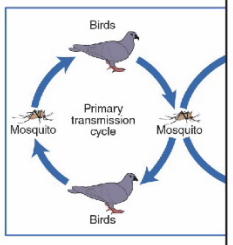
A	B	C	D	E	F
○	○	○	○	○	○

West Nile Virus Facts

West Nile Virus Transmission (from organism to organism)

West Nile virus primarily infects birds, but it can also infect bats, horses, cats, dogs, chipmunks, skunks, squirrels, rabbits, alligators, and humans. West Nile viruses are kept in the environment because they are easily transmitted between birds (the natural hosts of the virus) and mosquitoes.

Mosquitoes become infected with the West Nile virus when they bite birds that carry the virus. Mosquitoes usually do not become infected with the West Nile virus when they bite a human or horse. This is because the concentration of West Nile viruses in huma
the virus to mosquitoes.



West Nile viruses are spread to birds and other animals by the
number of birds and mosquitoes infected with West Nile virus
from bird to bird.

West Nile Virus Spread (from place to place)

Before 1999, West Nile virus had never been found in the Unit
Europe, the Middle East, and Africa. Birds infected with West
infected birds have spread West Nile virus to humans and anin
The red areas on the continental United States maps below sh
encephalitis in 1999, and 10 years later in 2009.

1999

2009

Modified from: https://www.cdc.gov/westnile/statsmaps

Virus Test Instructions

If a patient is infected with a virus, the patient's immune system will produce antibodies that will be present in the blood plasma of the patient. These antibodies attach to proteins on the surface of viruses. These virus surface proteins are called virus antigens.

1. The 6 circles on the **Virus Test Sheet** in this kit have been coated with virus antigens from 6 different types of viruses carried by mosquitoes in the eastern United States.

   A = Dengue Virus D = Yellow Fever Virus
   B = Chikungunya Virus E = Saint Louis Encephalitis Virus
   C = La Cross Virus F = Eastern Equine Encephalitis Virus

2. Add 2 drops of the **Patient 1 Blood Plasma** to each of the circles.

3. Observe the color of the test sheet circles. If a circle turns pink, it means that the patient's antibodies attached to the virus antigens on that circle.

Known RNA Sequences from Four Viruses Carried by Mosquitoes

Saint Louis Encephalitis Virus
AACAGCGAUGAAACACCUUCUGAGUUUUAAGAAAGAACUAGG

Dengue Virus
AACCCCAGUGCUGUCGGCCGGUAAUGAUCCAGAAGACAUCGA

West Nile Virus
AACCAAACUUAGUAGUGUUUGUGAGGAUUAACAACAAUUAACA

Yellow Fever Virus
AACUGUGUUUGUCGUGCUGUUGCUCUUGGUGGCUCCAGCUA

Read these instructions before using Science Take-Out kits

Parental or Adult Supervision Required

This kit should be used only under the supervision of an adult who is committed to ensuring that the safety precautions below, and in the specific laboratory activity, are followed.

Chemicals Used in Science Take-Out Kits

Every effort has been made to reduce the use of hazardous chemicals in Science Take-Out kits. Most kits contain common household chemicals or chemicals that pose little or no risk. Safety Data Sheets (SDS) provide specific safety information regarding the chemical contents of the kits. SDS information for each kit is provided in the accompanying teacher instructions. We encourage students to adopt safe lab practices when performing laboratory activities involving chemicals.

Warning: Choking and Chemical Hazard

Science Take-Out kits contain small parts that could pose a choking hazard and chemicals that could be hazardous if ingested. Do not allow children under the age of seven to have access to any kit components.

No blood or body fluids from humans or animals are used in Science Take-Out kits. Chemical mixtures are substituted as simulations of these substances.

General Safety Precautions

1. Never taste, smell, or ingest any chemicals provided in the kit - they may be hazardous.
2. Chemicals used in Science Take-Out experiments may stain or damage skin, clothing or work surfaces. If spills occur, wash the area immediately and thoroughly.
3. Report any chemical spills or contact with chemicals to your teacher.
4. Work in a clean, uncluttered area. Cover the work area to protect the work surface.
5. Read and follow all instructions carefully.
6. Pay particular attention to following the specific safety precautions provided by your teacher or included in the kit activity instructions.
7. Do not use the contents of this kit for any other purpose beyond those described in the kit instructions.
8. Do not leave experiment parts or kits where they could be used inappropriately by others.
9. Do not eat, drink, or apply make-up or contact lenses while performing experiments.
10. Wash your hands before and after performing experiments.

STO-174

Mysterious Case of Brain Illness

science take·out
just add students™

Part 1: What is causing an outbreak of encephalitis?

Eight patients were admitted to intensive care units at hospitals located in the same area of New York City. These patients experienced fever, seizures, confusion, muscle pain, and muscle weakness. Based on their symptoms, doctors suspect that the patients have encephalitis. Encephalitis is an inflammation (swelling) of the brain, often caused by a viral infection. It can lead to death or permanent disabilities.

Interviews with the patients and their families revealed only two things that the eight patients had in common. All of them lived in the same 2 x 2-mile area. All of them were involved in outdoor activities around their homes. These activities took place in the evenings when mosquitoes would be active and biting.

Environmental health investigators examined the patients' yards and neighborhoods. They found large populations of adult and developing mosquitoes. The environmental health investigators also observed many things filled with standing (non-moving) water such as buckets, trash cans, old tires, clogged gutters, and toys. Mosquitoes can breed (lay their eggs and develop) in even small amounts of standing water. The investigators reported that people could become infected if they are bitten by a mosquito that carries viruses.

1. Based on the results of the environmental investigations, what do you suspect might be causing the encephalitis outbreak?

_____

_____

Researchers want to conduct tests to identify what type of virus was causing the encephalitis. To do this, they will test for the presence of antibodies that a person's immune system will produce to fight the viruses. These antibodies prevent virus diseases by attaching to antigens (proteins) on the surface of viruses.

You will conduct tests to determine what antibodies are present in blood plasma (the liquid part of blood) from Patient 1. This will help you determine if Patient 1 has been infected with an encephalitis-causing virus known to be carried by mosquitoes in the United States.

2. Use the **Virus Test Sheet** in your kit. The circles on the **Virus Test Sheet** have been coated with antigens from six types of viruses (A–F) known to be carried by mosquitoes found in the United States.

3. You will test the blood plasma (the clear liquid part of blood) from Patient 1 to see if that patient has produced antibodies to fight any of the virus antigens on the test sheet. Follow the instructions on the **Virus Test Instructions** sheet to test **Patient 1 Blood Plasma.**

4. What is the name of the virus that is causing Patient 1's encephalitis? Support your answer with evidence from the antibody tests.

_____

_____

Tests conducted on blood plasma from the other seven encephalitis patients showed that their immune systems produced antibodies against the same type of virus as Patient 1. Testing of patients from surrounding towns and cities revealed that the same antibodies were present in the blood plasma of approximately 50 additional patients.

5. Explain how this virus can spread to affect the additional patients in surrounding towns and cities.

_____

_____

Part 2: Is there a link between bird deaths and the encephalitis outbreak?

For several weeks before and during the encephalitis outbreak in humans, veterinarians at a nearby zoo noticed a large die-off of birds. Captive birds, such as flamingos, and native birds, such as crows, were dying. Veterinarians examined the dead birds and discovered that the birds had died from encephalitis.

The veterinarians wondered if there might be a link between the outbreaks of bird encephalitis and the outbreaks of human encephalitis. Could the bird deaths be caused by the Saint Louis encephalitis virus? This seemed unlikely because the Saint Louis encephalitis virus had never been found in birds.

The veterinarians conducted genetic tests on the viruses from the brains of several dead crows and zoo birds. To identify the viruses that killed the birds, they compared the genetic information from these viruses to the genetic information from other animal viruses known to cause encephalitis.

1. Why did the veterinarians conduct genetic tests on viruses from the brains of the dead birds?

   _____

   _____

2. The genetic information for the viruses that cause encephalitis is coded in a sequence of nucleotide bases (A, U, C, G) in RNA molecules. The sequence of letters below represents part of an RNA molecule from the virus that killed one of the birds.

   AACCAAACUUAGUAGUGUUUGUGAGGAUUAACAACAAUUAACA

   - Compare this sequence of letters above with the sequences of letters on the **Known RNA Sequences from Four Viruses Carried by Mosquitoes** sheet.

   - Which type of virus most likely caused the bird encephalitis? Support your answer with evidence from the genetic information.

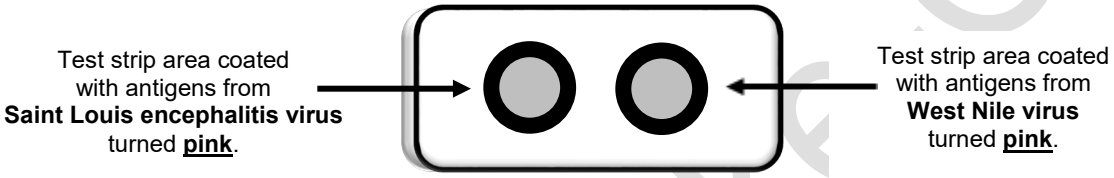
     _____

     _____

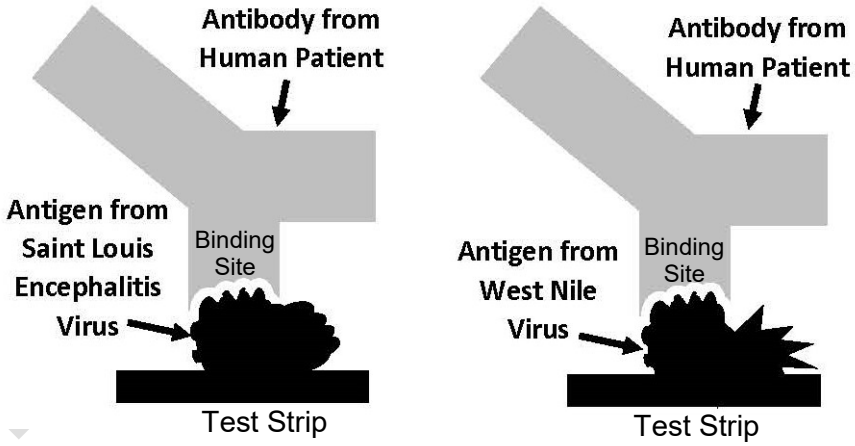
     _____

The veterinarians reported the results of the genetic tests on the viruses from the dead birds to the city Department of Health. Because the bird encephalitis and human encephalitis cases occurred at about the same time, scientists at the Department of Health wondered if the human encephalitis cases might be caused by West Nile virus instead of Saint Louis encephalitis virus.

To test this, the scientists added blood plasma from one of the human patients with encephalitis to a test strip that had been coated with antigens from Saint Louis encephalitis virus and antigens from West Nile virus. Both areas of the test strip turned pink, indicating that the patient's antibodies had attached to the antigens from both Saint Louis encephalitis virus and West Nile virus.



3. Antibodies have specific binding sites and will only attach to parts of antigens that fit into their binding site.



Use the information in the diagram above to explain why the antibodies in Patient 1's blood plasma could attach to antigens from both Saint Louis encephalitis virus and West Nile virus.

_____

_____

4. To determine whether Saint Louis encephalitis virus or West Nile virus was causing the human encephalitis outbreak, scientists from the Health Department did genetic tests on the viruses that cause human encephalitis. The genetic information below represents part of an RNA molecule from a virus that caused the outbreak of human encephalitis.

   AACCAAACUUAGUAGUGUUUGUGAGGAUUAACAACAAUUAACA

   - Compare this genetic information (sequence of letters) with the **Known RNA Sequences from Four Viruses Carried by Mosquitoes**.

   - Which type of virus caused the human encephalitis outbreak? Support your answer with evidence from the genetic information.

     _____

     _____

     _____

5. Explain how the work done by veterinarians was important in protecting human health.

   _____

   _____

Part 3: How is West Nile virus transmitted and spread?

Base your answers to question 1 through 4 on the information in the **West Nile Virus Facts** handout.

1. The transmission of West Nile virus from organism to organism is shown in the illustration in the **West Nile Virus Facts** handout. Based on the illustration, put an "**X**" in front of the statements below that are <u>correct</u>.

   _____ West Nile virus can be transmitted by human to human contact.

   _____ Birds can become infected with West Nile virus when they are bitten by mosquitoes.

   _____ Humans and horses can become infected with West Nile virus when they are bitten by mosquitoes.

   _____ Mosquitoes can become infected with West Nile virus when they bite birds.

   _____ Birds can transmit West Nile virus to other birds.

   _____ Birds can transmit West Nile virus to humans.

   _____ Mosquitoes can become infected with West Nile virus when they bite humans or horses.

2. What two organisms most likely carried West Nile virus to the United States from Europe, the Middle East, or Africa?

   _____

3. Explain how West Nile virus could spread so rapidly throughout the continental United States.

   _____

   _____

4. Predict where in the continental United States you would expect to find West Nile virus in 2019.

   _____

   _____

Part 4: Climate change and the West Nile virus

Base your answers to questions 1 through 4 on the **West Nile Virus Facts** handout.

1. What environmental factors might lead to increased bird populations in an area?

   _____

   _____

2. What environmental factors might lead to increased mosquito populations in an area?

   _____

   _____

3. People might change their activities in response to changing climates. This may cause an increase in their exposure to mosquitoes that carry the West Nile virus. Describe two examples of how climate change could change a person's activities and increase their exposure to mosquitoes.

   - _____

     _____

   - _____

     _____

4. Scientists claim that climate change is likely to cause an increase in the number of people infected with West Nile virus. Cite two pieces of evidence from the **West Nile Virus Facts** handout to support this claim.

   - _____

     _____

   - _____

     _____

Section 1 Chemical Product and Company Information

Science Take-Out
150 Office Park Way
Pittsford, NY 14534
(585)764-5400

CHEMTREC 24 Hour Emergency
Phone Number (800) 424-9300
For laboratory use only. Not for drug, food or household use

Product	Buffer Solution pH10
Synonyms	"Patient 1 Blood Plasma"

Section 2 Hazards Identification

This substance or mixture has not been classified at this time according to the Globally Harmonized System (GHS) of Classification and Labeling of Chemicals.

Signal word: WARNING
Pictograms: None required
Target organs: None known

GHS Classification:
Skin irritation (Category 3)
Eye irritation (Category 2B)

GHS Label information: **Hazard statement(s):**
H316: Causes mild skin irritation.
H320: Causes eye irritation.

Precautionary statement(s):

P264: Wash hands thoroughly after handling.

P305+P351+P338: IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.

P332+P313: If skin irritation occurs: Get medical attention.

P337+P313: If eye irritation persists: Get medical attention.

Ca Prop 65 - This product does not contain any chemicals known to the State of California to cause cancer, birth defects, or any other reproductive harm.

Section 3 Composition / Information on Ingredients

Chemical Name	CAS #	%	EINECS
Water	7732-18-5	99.08%	231-791-2
Potassium chloride	7447-40-7	0.40%	231-211-8
Boric acid	10043-35-3	0.33%	233-139-2
Sodium hydroxide	1310-73-2	0.19%	215-185-5

Section 4 First Aid Measures

INGESTION: Call physician or Poison Control Center immediately. Induce vomiting only if advised by appropriate medical personnel. Never give anything by mouth to an unconscious person.

INHALATION: Remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention.

EYE CONTACT: Check for and remove contact lenses. Flush thoroughly with water for at least 15 minutes, lifting upper and lower eyelids occasionally. Get immediate medical attention.

SKIN ABSORPTION: Remove contaminated clothing. Flush thoroughly with mild soap and water. If irritation occurs, get medical attention.

Section 5 Fire Fighting Measures

Suitable Extinguishing Media: Use any media suitable for extinguishing supporting fire.

Protective Actions for Fire-fighters: In fire conditions, wear a NIOSH/MSHA-approved self-contained breathing apparatus and full protective gear. Use water spray to keep fire-exposed containers cool.

Specific Hazards: During a fire, irritating and highly toxic gases may be generated by thermal decomposition or combustion.

Section 6 Accidental Release Measures

Personal Precautions: Evacuate personnel to safe area. Use proper personal protective equipment as indicated in Section 8. Provide adequate ventilation.

Environmental Precautions: Avoid runoff into storm sewers and ditches which lead to waterways.

Containment and Cleanup: Absorb with inert dry material, sweep or vacuum up and place in a suitable container for proper disposal. Wash spill area with soap and water.

Section 7 Handling and Storage

Precautions for Safe Handling: Read label on container before using. Do not wear contact lenses when working with chemicals. Keep out of reach of children. Avoid contact with eyes, skin and clothing. Do not inhale vapors, spray or mist. Use with adequate ventilation. Avoid ingestion. Wash thoroughly after handling. Remove and wash clothing before reuse.

Conditions for Safe Storage: Store in a cool, well-ventilated area away from incompatible substances.

Section 8 Exposure controls / Personal Protection

Exposure Limits:

Chemical Name	ACGIH (TLV)	OSHA (PEL)	NIOSH (REL)
Potassium chloride	None established	None established	None established

Engineering controls: Facilities storing or utilizing this material should be equipped with an eyewash facility and a safety shower and fire extinguishing material. Personnel should wear safety glasses, goggles, or faceshield, lab coat or apron, appropriate protective gloves. Use adequate ventilation to keep airborne concentrations low.

Respiratory protection: None should be needed in normal laboratory handling at room temperatures. If misty conditions prevail, work in fume hood or wear a NIOSH/MSHA approved respirator.

Section 9 Physical and Chemical Properties

Appearance: Clear, colorless liquid.
Odor: No odor.
Odor threshold: Data not available.
pH: 10.0
Melting/Freezing point: Approx. 0°C (32°F) (water)
Boiling point: Approx. 100°C (212°F) (water)
Flash point: Data not available

Evaporation rate (Water = 1): <1
Flammability (solid/gas): Data not available.
Explosion limits: Lower/Upper: Data not available
Vapor pressure (mm Hg): 14 (water)
Vapor density (Air = 1): 0.7 (water)
Relative density (Specific gravity): Approx. 1.0 (water)
Solubility(ies): Complete in water.

Partition coefficient: Data not available
Auto-ignition temp.: Data not available
Decomposition temp.: Data not available
Viscosity: Data not available.
Molecular formula: Mixture
Molecular weight: Mixture

Section 10 Stability and Reactivity

Chemical stability: Stable
Hazardous polymerization: Will not occur.

Conditions to avoid: Excessive temperatures which cause evaporation.
Incompatibilities with other materials: Acids, alkalies, and air will change the buffer's ability.
Hazardous decomposition products: Boron oxide and chlorine gas.

Section 11 Toxicological Information

Acute toxicity: Data not available
Serious eye damage/irritation: Data not available
Germ cell mutagenicity: Data not available
Skin corrosion/irritation: Data not available
Respiratory or skin sensitization: Data not available
Carcinogenity: Data not available

NTP: No component of this product present at levels greater than or equal to 0.1% is identified as a known or anticipated carcinogen by NTP.
IARC: No component of this product present at levels greater than or equal to 0.1% is identified as probable, possible or confirmed human carcinogen by IARC.
OSHA: No component of this product present at levels greater than or equal to 0.1% is identified as a carcinogen or potential carcinogen by OSHA.

Reproductive toxicity: Data not available
Aspiration hazard: Data not available
STOT-single exposure: Data not available
STOT-repeated exposure: Data not available

Potential health effects:
Inhalation: May be harmful if inhaled.
Ingestion: May be harmful if swallowed.
Skin: May cause mild irritation.
Eyes: May cause mild irritation.

Signs and symptoms of exposure: To the best of our knowledge the chemical, physical and toxicological properties have not been thoroughly investigated. Specific data is not available. Exercise appropriate procedures to minimize potential hazards.
Additional information: RTECS #: Data not available

Section 12 Ecological Information

Toxicity to fish: No data available
Toxicity to daphnia and other aquatic invertebrates: No data available
Toxicity to algae: No data available
Persistence and degradability: No data available
Mobility in soil: No data available
Bioaccumulative potential: No data available
PBT and vPvB assessment: No data available
Other adverse effects: An environmental hazard cannot be excluded in the event of unprofessional handling or disposal.

Section 13 Disposal Considerations

These disposal guidelines are intended for the disposal of catalog-size quantities only. Federal regulations may apply to empty container. State and/or local regulations may be different. Dispose of in accordance with all local, state and federal regulations or contract with a licensed chemical disposal agency.

Section 14 Transport Information

UN/NA number: Not applicable
Hazard class: Not applicable
Exceptions: Not applicable
Shipping name: Not Regulated
Packing group: Not applicable
2012 ERG Guide # Not applicable
Reportable Quantity: No
Marine pollutant: No

Section 15 Regulatory Information

A chemical is considered to be listed if the CAS number for the anhydrous form is on the Inventory list.

Component	TSCA	CERLCA (RQ)	RCRA code	DSL	NDSL	WHMIS Classification
Potassium Chloride	Listed	Not Listed	Not Listed	Listed	Not Listed	Uncontrolled Product
Sodium hydroxide	Listed	1,000 lbs (454 kg)	D002	Listed	Not Listed	E

Section 16 Additional Information

The information contained herein is furnished without warranty of any kind. Employers should use this information only as a supplement to other information gathered by them and must make independent determinations of suitability and completeness of information from all sources to assure proper use of these materials and the safety and health of employees.
NTP: National Toxicology Program, IARC: International Agency for Research on Cancer, OSHA: Occupational Safety and Health Administration, STOT: Specific Target Organ Toxicity, SE: Single Exposure, RE: Repeated Exposure, ERG: Emergency Response Guidebook.

Revision Date: September 19, 2023 Supercedes: