Q?rious Field Trip Guide
School Program: Mystery at Yorktown Creek

- Welcome to Q?rious
- Field Trip Logistics
  - Getting the Most from Q?rious
  - Class Overview
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SCIENCE EDUCATION AT THE SMITHSONIAN’S NATIONAL MUSEUM OF NATURAL HISTORY
Bringing the Museum’s collections, scientists, and research out from behind the scenes and within your reach
Welcome to Q?rius,
The Coralyn W. Whitney Science Education Center

Welcome to a New Kind of Field Trip

Thank you for choosing Q?rius at the Smithsonian’s National Museum of Natural History as your field trip destination! We think of Q?rius as both a place and an experience. We are excited to offer your students the chance to explore science, nature, and culture in a whole new way while supporting your curriculum needs.

We share your passion for learning! We have designed this Q?rius field trip to stimulate your students’ curiosity and to inspire them to better understand the world and their place in it.

Q?rius is an interactive and experimental learning space that brings the unique assets of the Smithsonian’s National Museum of Natural History - the science, researchers, and collections - out from behind the scenes. We call it Q?rius because it is designed to inspire curiosity in a whole new way in the next generation of scientists and science-minded citizens. It is an exhibit-sized interactive space filled with resources that are available only to your students at the world’s largest natural history museum, including:

- A collection of 6,000 objects – fossils, bones, insects, cultural artifacts, pressed plants, and more – all accessible for investigations, carefully selected to support learning goals connected to curriculum for your specific class experience
- A suite of digital tools, including videos, virtual objects, and references to maximize learning from objects and link objects to core science ideas and the people who study them
- Scientific tools integrated with all school experiences
- Student materials based on scientists’ field books to guide the Q?rius experience

The Q?rius Approach

All classes:
- Feature the work and amazing discoveries of Smithsonian scientists
- Link real-world research of Smithsonian scientists to curriculum standards for a unique approach to inspiring your students
- Use inquiry-based, team-oriented approaches to key questions similar to those addressed by Smithsonian scientists
- Reflect the input of teens and teachers with whom we partnered so that we could guarantee program appeal for students and relevance for teachers
- Integrate collections objects, data, scientific equipment, and digital assets to investigate core ideas

Questions? Please feel free to contact us at (202) 633-4039 or NMNHSchoolPrograms@si.edu.

naturalhistory.si.edu/schoolprograms
**FIELD TRIP LOGISTICS**

We look forward to your visit to Q?rius. The logistical information provided below will help you prepare for your visit and ensure a smooth arrival. *(Please see page 8 for information on introducing your students to field trip content.)*

| GETTING READY | • Carefully review your confirmation letter. To make any changes to your reservation, e-mail us at NMNHSchoolPrograms@si.edu or call us at (202) 633-4039. Or, visit https://naturalhistory.si.edu/education/school-programs/programs-school-groups-calendar, click on the “Wait List” button for the event you registered for, and select “Overwrite Previous Response if you have already registered for this event” on the registration form.  
• Review all information in this packet so that you know what you can expect from your visit. Contact us at NMNHSchoolPrograms@si.edu if you have questions or concerns.  
• Prior to arriving at the Museum, **please divide students into no more than 6 teams of 4-6 individuals who will pursue the class investigation together.**  
• Arrange for the proper number of chaperones (see below) and distribute the Chaperone Guide to them. |
|---|---|
| ARRIVAL AND DEPARTURE | **ADDRESS:** 10th Street NW and Constitution Avenue NW, Washington, D.C. 20013  
**HOURS:** School groups can enter the Museum anytime after 10:00 a.m.  
**ENTRANCES:** The entrance for school groups is at 10th Street and Constitution Ave., NW.  
**CLOSEST METRO STATIONS:** Federal Triangle or Smithsonian on the Blue, Orange or Silver Lines. Archives-Navy on the Green or Yellow Lines.  
**DROP-OFF BUS LANE:** From 9:30 a.m. to 12:00 p.m., Monday-Friday, the curb lane of Constitution Avenue adjacent to the Museum is reserved for school bus drop-off.  
**PICK-UP BUS LANE:** Please board buses on Madison Drive NW (the Museum exit on the Mall side).  
**SECURITY:** For the safety of your students, all bags will be inspected upon entry to the Museum. We encourage students to leave their backpacks/bags on the bus or at school to speed up the entry process. We will contact you before your visit about our express entry option. |
| RESTROOMS AND LUNCH | **RESTROOMS:** Restrooms are located near Q?rius on the Ground Floor in the Constitution Avenue Lobby and also on the First Floor, just off the Sant Ocean Hall.  
**LUNCH:** Food is available for purchase at the Atrium Café on the Ground Floor, or the Ocean Terrace Café on the First Floor of the museum. Limited bagged lunch seating is available in the Atrium Café. Bagged lunches must be stowed away at all times while visiting the museum and must only be eaten in the Atrium Café on the Ground Floor. The museum has no refrigerated storage for lunches. |
| CHAPERONEs | • To guarantee the best learning experience for your students, we require one chaperone for every 10 students in grades 6-8 and one chaperone for every 15 students in grades 9-12.  
• Please share the Chaperone Guide and lesson plans with your chaperones in advance so that they will be fully prepared to accompany and guide students in their learning. |
| CANCELLATION POLICY | If you need to cancel your school program(s), please notify us via email at least 72 hours in advance of your program. If you cancel within 24 hours of your visit, or are a no show for your school program, you will not be allowed to book a school program for the remainder of the school year. |
An Invitation to Experience Science

This School Program will engage your students in an immersive 60-minute program led by an experienced Museum Educator. Students will use objects, data, scientific equipment, and digital assets to investigate core ideas of natural history science and to gain skills in the practices of science. Students will complete a series of activities, document their results, and discuss their conclusions with each other and with the class.

In School: Starting the Experience

• Research shows that students who are oriented to the logistics of a field trip typically learn more from their experience than those who are not. Be sure to discuss schedule, lunch plans, restroom availability, and - most importantly - your expectations for students before arrival.
• Collaboration and communication are central components of science. You can prepare your students for collaboration by assigning them to teams of 4-6 individuals, no more than 6 teams total per program, in advance and asking them to brainstorm ways in which they will work as a team, learn as a team, and achieve consensus.
• Before your visit, review the scientific terms and preparation questions on page 7 with your students to prepare them for the content that will be covered during the program.
• Invite your students to practice their scientific inquiry skills by completing some of our online activities. These activities will introduce them to the types of investigations they will do on their field trip and get them exploring even before they arrive at the Museum!
• Remind students in advance that they will be working with valuable scientific equipment and collections, just like Museum scientists behind the scenes. These are important resources for learning more about the world and our place in it, and we ask that students treat equipment and collections with care and respect, just as our scientists do.

In Q?rius: Behind-the-Scenes Access

• Experienced Museum Educators and volunteers will lead your class. Students will also benefit significantly if their teachers and chaperones actively engage in the program, so please join in, remind them of the directions/instructions provided at each station, and support their learning.
• Just like scientists, students will work together in teams to complete an investigation, using real Museum specimens and sophisticated equipment.
• Equipment and objects are more accessible in Q?rius than anywhere else in the Museum. Students may need gentle reminders to treat objects and equipment carefully while investigating!
• To keep clutter to a minimum, personal items such as backpacks, lunches, and outerwear should be stored away from work tables.
• To protect the specimens, students are not allowed to have any gum or candy in Q?rius.
School Program: Mystery at Yorktown Creek

| CLASS DESCRIPTION | Erosion along a creek bed produces a startling discovery – a human skeleton! Before the clues are washed away forever, students will get the chance to examine the evidence collected by the archaeologist during this staff-led program. Using the forensic tools and techniques of Smithsonian scientists, they will study the human bones and artifacts found with the skeleton to determine who this person was, when they lived, and what their life might have been like. Uncover the mystery of a person whose burial could turn out to be over 200 years old! |
|SUMMARY OF STUDENT EXPERIENCE | Students will hone their powers of observation while using forensic tools and techniques to examine human bones, objects, and artifacts. Students will work in teams to develop their hypotheses, using a case file and data collection sheet to record observations, measurements, and other evidence gathered or observed. A Museum Educator will facilitate discussion to help students reconstruct this individual’s life history and compare their findings to those documented in the case report written by Smithsonian scientists. |
| GRADE RANGE | Grades 6-12 |
| DURATION OF PROGRAM | 60 minutes |

Scientist Focus

*Mystery at Yorktown Creek* gives students first-hand experience with the skills and practices used by Smithsonian scientist Doug Owsley, Division Head for Physical Anthropology, and research colleague Kari Bruwelheide. Every skeleton has a unique biological profile. In a forensic or archaeological investigation, a bone biography, combined with evidence at the scene of the excavation or crime, can answer many questions about an unidentified person. Bones may reveal significant information regarding age, diet, illness, injury, ancestry, height, sex, and cause of death. Owsley and Bruwelheide, along with their team of researchers, treat each new skeleton as a time capsule that can speak volumes for peoples and communities no longer able to speak for themselves.
Goals & Outcomes

GOAL
Applying their knowledge of human anatomy and their familiarity with scientific practices such as asking questions, gathering evidence, and building conclusions, students will solve a real-world forensic mystery case. They will employ scientific tools, techniques, and problem-solving skills similar to those used by forensic anthropologists to learn about an individual’s life from skeletal remains and other evidence.

LEARNING OBJECTIVES
In this investigation students will:
• Examine skeletal remains and associated artifacts
• Gather data about the bones, objects, and artifacts by comparison to various reference materials, including other human bones, growth and development charts, databases, and historical references
• Use x-ray technology and measuring tools as a method for collecting data
• Analyze and synthesize collected data

STUDENT OUTCOMES
After participating in Mystery at Yorktown Creek, students will be better able to:
• Use tools and techniques to gather data from human remains
• Ask questions and interpret data relevant to the context in which skeletons are found
• Cite relevant evidence to explain their analysis
• Explain how forensic anthropologists examine bones and describe the tools that they use when working real-world cases

Central Questions and Concepts
• What can we tell about a person from the remains found at a site?
• What can we tell about the person’s age, sex, height, and health?
• What can we tell about the way that person lived from their skeleton?
• What can we tell about how that person died from their skeleton?
• What can we tell about time of death from their skeleton?
**Case Background**

Erosion along a river bank near Yorktown, Virginia, produced a startling discovery – a human skeleton! Local law enforcement officials ruled out the possibility of a modern crime. Archaeologists arrived at the scene to perform salvage archaeology, recording and recovering as much evidence as possible before the rising river destroyed the site.

After carefully documenting the skeletal remains and other artifacts at the site, the archaeologists transferred the case to the National Museum of Natural History for examination and report.

There is no historical documentation to suggest that a cemetery ever existed at the site. Could the bones or artifacts offer clues to help identify the remains?

The Yorktown area actually has a rich history of settlement. In the 1600’s, some of the earliest English settlements in the colonization of America occupied the area. Over the next two centuries, Yorktown became a bustling port and mercantile town focused on the growth and sale of tobacco. It also was a significant slave port, providing much needed labor to the tobacco industry. In 1781, the last battle of the American Revolution was fought at Yorktown. During the Civil War, both Union and Confederate troops occupied the town at one time or another.

Students will move through six stations containing skeletal remains and objects from the Yorktown site. Each station will focus on one of the following themes: age, sex, stature, pathology, historical context, and scientific context. With a Museum Educator facilitating discussion, students will study the skeletal remains, reconstruct the life history of the person, and then place that person in historical context based on their knowledge of colonial America.
Program Format

ARRIVAL
You can find the entrance to Q?rius in the Constitution Avenue lobby on the Ground Floor of the Museum. If your class begins at 10:15 a.m., please enter the Museum at Constitution Avenue and 10th Street beginning at 10:00 a.m. If you will be exploring the Museum before your Q?rius class, please bring your students to the Constitution Avenue lobby 15 minutes prior to the start of your class.

A Museum Educator will meet your group and escort you to a Q?rius classroom. Please do not enter Q?rius on your own. The educator then will introduce students to the forensic case, explain what is expected of them as scientists, teach them the techniques for handling evidence, and show them the available tools. Every team will receive a case file that will include a data collection sheet that students can use to record their observations, measurements, and any other data gathered or observed.

INTRODUCTION (5 MINUTES)
Through a classroom discussion led by a Museum Educator, students will explore forensic practices and concepts, and receive an overview of the case.

INVESTIGATION (35 MINUTES)
Working in small teams of 4–6 individuals, students will rotate among six investigation stations. Teams will have five to six minutes at each station to examine the evidence, make observations, collect data, and analyze it. At each station, students will use reference bones, books, charts, and measuring tools to aid them in their investigation.

Program activities can be adjusted for grade level and with consideration to experience with forensic practices and concepts. Additional human skeletal remains and objects requiring more observation, offering subtle diagnostic features and a richer context, may be provided. Additional reference materials that are more detailed and complex also may be included. In these instances, students would be expected to provide more detailed findings and analysis.

DISCUSSION AND CONCLUSION (20 MINUTES)
At the end of their investigation students will work together to assemble their data and construct an explanation about the individual in this case. Student groups will report their results and justify their conclusions, drawing upon evidence from their work. They will compare their results to those generated by NMNH forensic anthropologists.
Before Your Visit

GRADES 6-8

SCIENTIFIC TERMS
The Mystery at Yorktown Creek class will use these terms in the context of natural history scientific investigations. Please review these terms with students before arrival.

ancestry  osteology  preservation
cranium  eruption  anthropology
forensic  excavate  forensic anthropologist

PREPARATION QUESTIONS
1. What are some of the things we can learn from studying skeletons from the past? Where else can we get this information?
2. What can forensic anthropologists learn from bone analysis that we cannot learn from other kinds of historical sources?
3. What are some of the ways forensic anthropologists determine the history of the people whose bones they discover?
4. How would a forensic anthropologist determine whether a skeleton was buried 400 years ago or four years ago?

GRADES 9-12

SCIENTIFIC TERMS
The Mystery at Yorktown Creek class will use these terms in the context of natural history scientific investigations. Please review these terms with students before arrival, as well as the terms for grades 6-8 as needed.

antemortem  postmortem  ancestry versus race
perimortem  sex versus gender  salvage archaeology

PREPARATION QUESTIONS
1. What features of a person’s skeleton change over time? How can forensic anthropologists use that information to establish identity?
2. Other than the bones themselves, what do forensic anthropologists look at for clues to wealth and social status? What can archaeological evidence tell us that we cannot learn from other sources?
3. Would you expect there to be significant differences between our skeletons and those of people born 100 years in the future? What sort of differences?
4. Why are teeth studied so closely? How can they suggest a person’s age? What evidence can teeth provide about diet, and what conclusions might be drawn from that evidence?

SMITHSONIAN SCIENCE HOW: FORENSIC ANTHROPOLOGY - BONE WHISPERING

FEATURING FORENSIC ANTHROPOLOGIST KARI BRUWELHEIDE

Prepare students to participate in Mystery at Yorktown Creek by watching featured scientist Kari Bruwelheide’s archived Smithsonian Science How webcast.

https://naturalhistory.si.edu/education/teaching-resources/social-studies/forensic-anthropology-bone-whispering

Kari Bruwelheide is a Forensic Anthropologist at the National Museum of Natural History. Join her in understanding what skeletons can tell you about how people lived and died. Probe into the mysteries contained in human bones. See the sophisticated technologies being used to extract information from bones, and think about what technologies might enhance the study of bones in the future. Consider what skeletons can reveal about people and places of the past. Learn how Kari is analyzing skeletal remains in conjunction with historical records and other artifacts to recreate a picture of human life in the Colonial Chesapeake.
## Post-Program: Curiosity Continues

The National Museum of Natural History’s education webpage [https://naturalhistory.si.edu/education](https://naturalhistory.si.edu/education) offers a variety of different follow-up opportunities for your students. Students can conduct an investigation with an online activity, jump into science stories, watch a webcast, or explore science in action.

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<thead>
<tr>
<th>TEACHING RESOURCES</th>
<th>WRITTEN IN BONE</th>
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<tr>
<td></td>
<td><a href="http://naturalhistory.si.edu/education/teaching-resources/written-bone">http://naturalhistory.si.edu/education/teaching-resources/written-bone</a></td>
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<tr>
<td></td>
<td>The <em>Written in Bone</em> website offers a wealth of teaching resources. Explore Forensic Case File, the Webcomic The Secret in the Cellar, and Skeleton Keys – the basics of “reading” bones.</td>
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<tr>
<th>EXHIBIT CONNECTIONS</th>
<th>The <em>Eternal Life in Ancient Egypt</em> exhibit provides another application of forensic anthropology skills and practices.</th>
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<td></td>
<td><strong>SUGGESTED ACTIVITY:</strong> In the exhibition, students can gather examples for post-visit classroom discussion of practices and skills used by anthropologists in studying mummified remains. <a href="https://naturalhistory.si.edu/exhibits/eternal-life-ancient-egypt">https://naturalhistory.si.edu/exhibits/eternal-life-ancient-egypt</a></td>
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<td></td>
<td>The <em>Osteology: Bone Hall</em> displays a skeletal collection representing all animal groups.</td>
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<td><strong>SUGGESTED ACTIVITY:</strong> In the exhibition, students can complete a comparative anatomy observation lab by examining similarities and differences of skeletal structures of different classes of animals. <a href="https://naturalhistory.si.edu/exhibits/bone-hall">https://naturalhistory.si.edu/exhibits/bone-hall</a></td>
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| LIVE SMITHSONIAN SCIENCE HOW WEBCASTS | *Smithsonian Science How* delivers real-world science into classrooms through free, interactive, live webcasts and supporting classroom resources. The 30-minute programs feature the research and personalities of the Smithsonian’s National Museum of Natural History, providing your students with positive STEM role models, information about science careers and pathways, and connections to current research. Every webcast includes a package of standards-aligned teaching resources that includes lessons, activities, and other resources that highlight science content and practice. [https://naturalhistory.si.edu/education/distance-learning](https://naturalhistory.si.edu/education/distance-learning) |

| SMITHSONIAN SCIENCE HOW VIDEO LIBRARY | Visit our video library to watch the collection of dozens of *Smithsonian Science How* videos, featuring experts and topics in the subject areas of earth science, life science, paleontology, and social studies. Each video has a complementary package of standards aligned teaching resources that include lessons, activities, and other resources that highlight science content and practice. [https://naturalhistory.si.edu/education/distance-learning/smithsonian-science-how-webcast-archives](https://naturalhistory.si.edu/education/distance-learning/smithsonian-science-how-webcast-archives) |
Associated Standards

Participating in *Mystery at Yorktown Creek* supports students in being better able to meet the following standards. The degree to which standards are addressed will depend on student participation, preparation, and connections made in the classroom.

**Next Generation Science Standards**

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<tr>
<th>MIDDLE SCHOOL</th>
<th>HIGH SCHOOL</th>
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<tr>
<td><strong>MS-LS1 FROM MOLECULES TO ORGANISMS: STRUCTURES AND PROCESSES</strong></td>
<td><strong>HS-LS1 FROM MOLECULES TO ORGANISMS: STRUCTURES AND PROCESSES</strong></td>
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<tr>
<td><strong>MS-LS1-1</strong> Conduct an investigation to provide evidence that living things are made of cells; either one cell or many different numbers and types of cells.</td>
<td><strong>HS-LS1-2</strong> Develop and use a model to illustrate the hierarchical organization of interacting systems that provide specific functions within multicellular organisms.</td>
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<tr>
<td><strong>MS-LS1-3</strong> Use argument supported by evidence for how the body is a system of interacting subsystems composed of groups of cells.</td>
<td><strong>HS-LS4 BIOLOGICAL EVOLUTION: UNITY AND DIVERSITY</strong></td>
</tr>
<tr>
<td><strong>MS-LS1-5</strong> Construct a scientific explanation based on evidence for how environmental and genetic factors influence the growth of organisms.</td>
<td><strong>HS-LS4-1</strong> Communicate scientific information that common ancestry and biological evolution are supported by multiple lines of empirical evidence.</td>
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**National Curriculum Standards for Social Studies (NCSS)**

**TIME, CONTINUITY, AND CHANGE**

- Studying the past makes it possible for us to understand the human story across time.
- Knowledge and understanding of the past enable us to analyze the causes and consequences of events and developments, and to place these in the context of the institutions, values and beliefs of the periods in which they took place.
- Knowing how to read, reconstruct and interpret the past allows us to answer questions such as: How do we learn about the past? How can we evaluate the usefulness and degree of reliability of different historical sources?

**PEOPLE, PLACES, AND ENVIRONMENTS**

- The study of people, places, and environments enables us to understand the relationship between human populations and the physical world.
- During their studies, learners develop an understanding of spatial perspectives, and examine changes in the relationship between peoples, places and environments.
## Science Standards of Learning for Virginia Public Schools

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<tr>
<th>GRADE 6</th>
<th>MIDDLE &amp; HIGH SCHOOL</th>
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<tr>
<td><strong>SCIENTIFIC INVESTIGATION, REASONING, AND LOGIC</strong></td>
<td><strong>PHYSICAL SCIENCE</strong></td>
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<tr>
<td>6.1 The student will demonstrate an understanding of scientific reasoning, logic, and the nature of science by planning and conducting investigations in which</td>
<td>PS.1 The student will demonstrate an understanding of scientific reasoning, logic, and the nature of science by planning and conducting investigations in which</td>
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<tr>
<td>a. observations are made involving fine discrimination between similar objects and organisms</td>
<td>c. conversions are made among metric units, applying appropriate prefixes</td>
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<tr>
<td>b. precise and approximate measurements are recorded</td>
<td>j. valid conclusions are made after analyzing data</td>
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<tr>
<td>e. a method is devised to test the validity of predictions and inferences</td>
<td>k. research methods are used to investigate practical problems and questions</td>
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<tr>
<td>g. data are collected, recorded, analyzed, and reported using metric measurements and tools</td>
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<tr>
<td>j. current applications are used to reinforce science concepts</td>
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<tr>
<td><strong>BIOLOGY</strong></td>
<td><strong>BIO.1</strong> The student will demonstrate an understanding of scientific reasoning, logic, and the nature of science by planning and conducting investigations in which</td>
</tr>
<tr>
<td>b. hypotheses are formulated based on direct observations and information from scientific literature;</td>
<td>b. hypotheses are formulated based on direct observations and information from scientific literature;</td>
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<tr>
<td>e. conclusions are formed based on recorded quantitative and qualitative data</td>
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<tr>
<td>g. validity of data is determined</td>
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<tr>
<td>l. alternative scientific explanations and models are recognized and analyzed; and</td>
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*Need additional standards alignment? Please contact us for the full list of associated standards.*