OpenSciEd Massachusetts Standards Guidance
7th Grade: Natural Hazards

This document is to provide guidance to Massachusetts 7th grade teachers who are implementing OpenSciEd. This guidance assumes the OpenSciEd curriculum is being implemented across grades 6-8, following the MA coherent sequence by grade level *(download)*. The following guidance identifies the MA standards addressed in the *Natural Hazards* unit, and the most effective use of the OpenSciEd materials for 7th grade teachers.

Scope and Sequence Recommendation

Implement the *Natural Hazards* unit in 7th grade at the end of the year, after the *Natural Resources & Human Impact* unit. *Natural Hazards* has significant coherence when building on experiences from the *Natural Resources & Human Impact* unit (recommended for 7th grade in MA). *Natural Hazards* addresses four 7th grade earth & space and engineering & technology science standards, and two 6th grade physical science and engineering & technology standards. Refer to the MA coherent sequence by grade level *(download)* for the complete scope and sequence recommendation.

7th Grade Standards in *Natural Hazards*

Standards in unit	Lessons building towards standards
7.MS-ESS3-2. Obtain and communicate information on how data from past geologic events are analyzed for patterns and used to forecast the location and likelihood of future catastrophic events.	Lessons 1-4
7.MS-ETS1-2. **[Partial]** Evaluate competing solutions to a given design problem using a decision matrix to determine how well each meets the criteria and constraints of the problem. Use a model of each solution to evaluate how variations in one or more design features, including size, shape, weight, or cost, may affect the function or effectiveness of the solution. • **Why partial?** In this unit, students evaluate multiple communication system designs, but only model one tsunami warning communication system – they do not use the model to evaluate changes in design. • This standard is addressed in full across several other units, notably *Contact Forces, Ecosystem Dynamics & Biodiversity, Earth's Resources and Human Impact* and *Chemical Reactions & Energy.* No changes are recommended to address this standard.	Lessons 6-9
7.MS-ETS3-1(MA). **[Partial]** Explain the function of a communication system and the role of its components, including a source, encoder, transmitter, receiver, decoder, and storage. • **Why partial?** This standard is foundationally addressed, but may not provide sufficient support around the key terms (source, encoder, etc.) and their functions. **See extension activities below** in order to more fully address this standard.	Lessons 6, 8
7.MS-ETS3-2(MA). Compare the benefits and drawbacks of different communication systems.	Lessons 7-10

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Additional Standards in *Natural Hazards*

Standards in unit	Lessons building towards standards
6.MS-PS4-3. Present qualitative scientific and technical information to support the claim that digitized signals (sent as wave pulses representing 0s and 1s) can be used to encode and transmit information.	Lessons 6, 8
6.MS-ETS1-1. Define the criteria and constraints of a design problem with sufficient precision to ensure a successful solution. Include potential impacts on people and the natural environment that may limit possible solutions.	Lessons 5, 6

See recommendations below for addressing these 6th grade standards.

Recommendations for Addressing Standards in *Natural Hazards*

Include, and teach 6.MS-PS4-3 and 6.MS-ETS1-1 with *Natural Hazards* as planned in the unit. 6.MS-PS4-3 is addressed foundationally in this unit and not in any other OpenSciEd unit, so should not be omitted within an implementation program. 6.MS-ETS1-1 is integrated in such a way to support the 7th grade engineering standards for this unit. **Excluding this standard would require substantial redesign of the unit, which is not recommended.**

Extension Activities to Fully Address Standards in *Natural Hazards*

The following extension activities may be used to fully address standard **7.MS-ETS3-1(MA).**

Lesson	Extension Activity
Lesson 6	**Section 2 – Do a Close Reading on How Tsunami Signals are Sent** • During lesson 6, students read an article entitled "How are tsunamis detected and warning signals sent?" • Modify the language in the article so that the words "source", "transmit", "encode", "receive", and "decode" are embedded in the descriptions of the DART II system. • For example, you could replace the text on page 2 with the following: "When the seismometers on land detect an earthquake that might cause a tsunami, they **encode** and **transmit** a signal to a satellite that is orbiting Earth. **When the** satellite **receives** the signal, it then **transmits** signals to several floating buoys on the surface of the ocean near the earthquake's epicenter. The surface buoy **receives** and **decodes** sonar waves from the tsunameter, and then **encodes** them as satellite signals. Next, each surface buoy **transmits** a signal to wake up an instrument down on the ocean floor called a tsunameter. You might be wondering why we don't send the signal from the satellite directly to the tsunameter--it turns out that satellite signals do not travel well through water. Fortunately, sound travels very quickly through water. So, sound waves, or sonar, are used to **transmit** signals from the tsunameter."

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	• The learning plan on page 8 in the teacher guide already provides guidance for discussing technical vocabulary after the reading. You can add the words to your "words we encounter" list for the time being. **Section 5 - Navigation** • Currently, the learning plan has you navigate to what happens after the signal from the tsunameter is sent. • At this point, you could modify slide F to read **"How will the warning be communicated to the people?"** and guide the discussion to be more around how exactly the tsunameter works, and how communication systems work in general. Motivate the need to understand what the common components are between different communication system.
Lesson 7	Sections 1-5 can be completed as written. **Section 6** • Before digging into the students' criteria and constraints, tell the students that you'd like to think about some common language around communication systems and the components that are common to communication systems. • You might create a slide that reads: "what components do communication systems have in common?" • Students will likely have learned the terms "system" and "component" in previous units, in particular the *Matter Cycling and Photosynthesis* unit. You can review these ideas. • Return to the diagram of the DART II system from lesson 6. Have the students talk through the process by which the signals are sent. Work with the students to identify that there is a **source** that a signal comes from, that it is **encoded** into a specific format (sound waves, satellite signals), and **transmitted** to something that receives the **signal**. Point out that at the surface buoy, the signal has to be **decoded** and then re-**encoded** as a different kind of signal in order to reach the satellite. • Create a flow chart that shows this process, emphasizing the terms source, encoder, transmitter, receiver, decoder. Discuss the idea that the information then might be re-encoded in a new format, and that it may then be **stored** in a computer or somewhere else. • Have the students return to their home learning and the types of communication systems that they identified. Have them discuss in groups - do other forms of communication work this way? • Challenge students to see the similarities - how when we speak, we are encoding ideas as sound waves, and decoding sound waves back into ideas. • Have the students revisit their "Criteria and Constraints" document. It is possible that they may use their new ideas about communication systems in general to update the document. • Resume lesson 7 as written, but encourage students to use the terms source, encoder, transmitter, receiver, decoder, and storage as appropriate during the unit.
Lesson 8	Continue to reinforce and prompt students to use the communication system vocabulary throughout lesson 8.

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	Section 3 - Building Understandings about Reliability of Signals in an Emergency • Purposefully integrate the communication system vocabulary into this discussion. • For example, have students think about whether it is important to minimize the number of times information must be decoded/encoded. • If students are struggling to think about this, you could play "Telephone" to show that repeatedly encoding and decoding information can degrade the information over time. **Section 4 - Navigation** Look for appropriate usage of the communication system vocabulary on the exit tickets.
Lesson 9	Continue to support and reinforce the usage of communication system vocabulary throughout lesson 9 discussions.
Lesson 10	**Section 10 - Begin Natural Hazards communication plan** • Modify the Hazard Communication Planning Handout to explicitly prompt students to identify the components of their communication plan and possible places where information is being encoded/decoded. • If desired, prompt students to use communication system vocabulary throughout their plan.