

## MS-ESS3-1 Earth and Human Activity

Students who demonstrate understanding can:

**MS-ESS3-1. Construct a scientific explanation based on evidence for how the uneven distributions of Earth's mineral, energy, and groundwater resources are the result of past and current geoscience processes.** [Clarification Statement: Emphasis is on how these resources are limited and typically non-renewable, and how their distributions are significantly changing as a result of removal by humans. Examples of uneven distributions of resources as a result of past processes include but are not limited to petroleum (locations of the burial of organic marine sediments and subsequent geologic traps), metal ores (locations of past volcanic and hydrothermal activity associated with subduction zones), and soil (locations of active weathering and/or deposition of rock).]

The performance expectation above was developed using the following elements from the NRC document *A Framework for K-12 Science Education*:

### Science and Engineering Practices

#### Constructing Explanations and Designing Solutions

Constructing explanations and designing solutions in 6–8 builds on K–5 experiences and progresses to include constructing explanations and designing solutions supported by multiple sources of evidence consistent with scientific ideas, principles, and theories.

- Construct a scientific explanation based on valid and reliable evidence obtained from sources (including the students' own experiments) and the assumption that theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future.

### Disciplinary Core Ideas

#### ESS3.A: Natural Resources

- Humans depend on Earth's land, ocean, atmosphere, and biosphere for many different resources. Minerals, fresh water, and biosphere resources are limited, and many are not renewable or replaceable over human lifetimes. These resources are distributed unevenly around the planet as a result of past geologic processes.

### Crosscutting Concepts

#### Cause and Effect

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

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#### *Connections to Engineering, Technology, and Applications of Science*

#### Influence of Science, Engineering, and Technology on Society and the Natural World

- All human activity draws on natural resources and has both short and long-term consequences, positive as well as negative, for the health of people and the natural environment.

### Observable features of the student performance by the end of the course:

1	Articulating the explanation of phenomena
a	Students articulate a statement relating a given phenomenon to scientific ideas, including that past and current geoscience processes have caused the uneven distribution of the Earth's resources, including: <ul style="list-style-type: none"> <li>i. That the uneven distributions of the Earth's mineral, energy, and groundwater resources are the results of past and current geologic processes.</li> <li>ii. That resources are typically limited and nonrenewable due to factors such as the long amounts of time required for some resources to form or the environment in which resources were created forming once or only rarely in the Earth's history.</li> </ul>
b	Students use evidence and reasoning to construct a scientific explanation of the phenomenon.
2	Identifying the scientific evidence to construct the explanation
a	Students identify and describe the evidence necessary for constructing the explanation, including: <ul style="list-style-type: none"> <li>i. Type and distribution of an example of each type of Earth resource: mineral, energy, and groundwater.</li> <li>ii. Evidence for the past and current geologic processes (e.g., volcanic activity, sedimentary processes) that have resulted in the formation of each of the given resources.</li> </ul>

	iii.	The ways in which the extraction of each type of resource by humans changes how much and where more of that resource can be found.
	b	Students use multiple valid and reliable sources of evidence.
3	Reasoning	
	a	Students use reasoning to connect the evidence and support an explanation. Students describe a chain of reasoning that includes:
	i.	The Earth's resources are formed as a result of past and current geologic processes.
	ii.	The environment or conditions that formed the resources are specific to certain areas and/or times on Earth, thus identifying why those resources are found only in those specific places/periods.
	iii.	As resources as used, they are depleted from the sources until they can be replenished, mainly through geologic processes.
	iv.	Because many resources continue to be formed in the same ways that they were in the past, and because the amount of time required to form most of these resources (e.g., minerals, fossil fuels) is much longer than timescales of human lifetimes, these resources are limited to current and near-future generations. Some resources (e.g., groundwater) can be replenished on human timescales and are limited based on distribution.
	v.	The extraction and use of resources by humans decreases the amounts of these resources available in some locations and changes the overall distribution of these resources on Earth.