Unit 4: Air and Air Pollution

Content Area: **Science**
Course(s):
Time Period: **MP2**
Length: **25 days**
Status: **Published**

NJSLS - Science

9-12.HS-ESS2-1	Develop a model to illustrate how Earth's internal and surface processes operate at different spatial and temporal scales to form continental and ocean-floor features.
9-12.HS-ESS2-7	Construct an argument based on evidence about the simultaneous coevolution of Earth's systems and life on Earth.
9-12.HS-ESS2-6	Develop a quantitative model to describe the cycling of carbon among the hydrosphere, atmosphere, geosphere, and biosphere.

Science and Engineering Practices

Developing and Using Models

Develop a model based on evidence to illustrate the relationships between systems or between components of a system. (HS-ESS2-1),(HS-ESS2-3),(HS-ESS2-6)

Engaging in Argument from Evidence

Construct an oral and written argument or counter-argument based on data and evidence. (HS-ESS2-7)

Disciplinary Core Ideas

SS2.A: Earth Materials and Systems

Earth's systems, being dynamic and interacting, cause feedback effects that can increase or decrease the original changes. (HS-ESS2-1),(HS-ESS2-2)

ESS2.D: Weather and Climate

Gradual atmospheric changes were due to plants and other organisms that captured carbon dioxide and

released oxygen. (HS-ESS2-6),(HS-ESS2-7)

Changes in the atmosphere due to human acvity have increased carbon dioxide concentraons and thus affect climate. (HS-ESS2- 6)

ESS2.E Biogeology

The many dynamic and delicate feedbacks between the biosphere and other Earth systems cause a continual co-evolution of Earth's surface and the life that exists on it. (HS-ESS2-7)

Crosscutting Concepts

Energy and Matter

The total amount of energy and matter in closed systems is conserved. (HS-ESS2-6)

Stability and Change

Much of science deals with constructing explanations of how things change and how they remain stable. (HS-ESS2-7)

Change and rates of change can be quanfied and modeled over very short or very long periods of me. Some system changes are irreversible. (HS-ESS2-1)

Rationale and Transfer Goals

The purpose of this unit is to understand the different types of pollutants that affect air quality, and the ways in which air pollution is produced and the ways in which it can be reduced. Air polluon has short and long term effects on health. The source of air pollutants can be difficult to determine.

Enduring Understandings

- Many pollutants in the air come from human acvies.
- Pollutants in the air can have short term and long term effects on health.
- There are laws in place to monitor air quality, with government agencies in place to regulate.

- Pollutants in the air can negavely impact other species as well. Ex: acid rain from the atmosphere accumulates in the soil and can negavely affect plant growth

Essential Questions

- How do changes in the geosphere affect the atmosphere?
- How does carbon cycle among the hydrosphere, atmosphere, geosphere, and biosphere?
- How do living organisms alter Earth's processes and structures?

Content - What will students know?

- Earth’s systems, being dynamic and interacting, cause feedback effects that can increase or decrease the original changes.
- The foundation for Earth’s global climate systems is the electromagnetic radiation from the sun, as well as its reflection, absorption, storage, and redistribution among the atmosphere, ocean, and land systems, and this energy’s re-radiation into space.
- Feedback (negative or positive) can stabilize or destabilize a system.
- Gradual atmospheric changes were due to plants and other organisms that captured carbon dioxide and released oxygen.
- Changes in the atmosphere due to human acvity have increased carbon dioxide concentrations and thus affect climate.
- The total amount of energy and matter in closed systems is conserved.
- The total amount of carbon cycling among and between the hydrosphere, atmosphere, geosphere, and biosphere is conserved.
- The many dynamic and delicate feedbacks between the biosphere and other Earth systems cause a continual co-evolution of Earth's surface and the life that exists on it.

Skills - What will students be able to do?

- Describe the primary air pollutants and their main source. (EX: CO is a primary pollutant, and one of its main sources is cars)
- Describe how smog forms.
- Explain how temperature inversions can form, and how it can trap even more pollutants.
- Examine the impacts of air pollutants on human health. (short-term and long-term)
- ID problem areas in a house plan that may lead to higher indoor air pollution. (look at types of chemical cleaners in a house, ventilation, smoking, etc.)
- Correlate sick building syndrome with warmer environments.
- Explain the causes of acid precipitation
- Design an experiment to test the effects of acid precipitation on plant growth.
- Present and analyze data showing the effects of acid precipitation on plant growth.

- Describe ways that the US and other countries monitor acid precipitation and other air pollutants.

Activities - How will we teach the content and skills?

- Analyze geoscience data using tools, technologies, and/or models (e.g., computational, mathematical) to claim that one change to Earth's surface can create feedbacks that cause changes to other Earth systems.
- Develop a model based on evidence to describe the cycling of carbon among the hydrosphere, atmosphere, geosphere, and biosphere.
- Develop a model based on evidence to illustrate the biogeochemical cycles that include the cycling of carbon through the ocean, atmosphere, soil, and biosphere, providing the foundation for living organisms.
- Construct an argument based on evidence about the simultaneous co-evolution of Earth's systems and life on Earth.

Evidence/Assessments - How will we know what students have learned?

Environmental Benchmark #2

Spiraling for Mastery

Content or Skill for this Unit	Spiral Focus from Previous Unit	Instructional Activity
• Earth's systems, being dynamic and interacting, cause feedback effects that can increase or decrease the original changes. • Gradual atmospheric changes were due to plants and other organisms that captured carbon dioxide and released oxygen. • The many dynamic and delicate feedbacks between the biosphere and other Earth systems cause a continual co-evolution of Earth's surface and the life	• Organisms, and populations of organisms, are dependent on their environmental interactions both with other living things and with nonliving factors. • In any ecosystem, organisms, and populations with similar requirements for food, water, oxygen, or other resources may compete with each other for limited resources, access to which consequently constrains	• Resources from the Holt Environmental Science Text: o MathPracce: Utility Incentives for Zero-emission Vehicles o Student Opportunities: The Yellow Bikes Program o Case Study: The Health Effects of Ground-Level Ozone o Using the Figure: Indoor Air

that exists on it. • The total amount of carbon cycling among and between the hydrosphere, atmosphere, geosphere, and biosphere is conserved. • Changes in the atmosphere due to human acvity have increased carbon dioxide concentrations and thus affect climate.	their growth and reproduction. The growth of organisms and population increases are limited by access to resources. • Ecosystems are dynamic; their characteristics can vary over me. Disruptions to any physical or biological component of an ecosystem can lead to this in all its populations. • Biodiversity describes the variety of species found in Earth's terrestrial and oceanic ecosystems. The completeness or integrity of an ecosystem's biodiversity is often used as a measure of its health. • Adaptation by natural selection acng over generations is one important process by which species change over time in response to changes in environmental conditions. Traits that support successful survival and reproduction in the new environment become more common; those that do not become less common. Thus, the distribution of traits in a population changes	Pollution ○ Graphic Organizer: Chain-of-Events Chart ○ Maps in Action: Light Sources ○ Map Skills: Pollution Levels

Key Resources

Greenhouse Effect: Students explore the atmosphere during the ice age and today. What happens when you add clouds? Change the greenhouse gas concentration and see how the temperature changes. Then compare the effect of glass panes. Zoom in and see how light interacts with molecules. Do all atmospheric gases contribute to the greenhouse effect?

Earth Systems Activity: Students model the carbon cycle and its connection with Earth's climate.

Carbon and Climate: Students run a model of carbon sources and sinks and interpret results to develop their model of the relationship of the carbon cycle to the Earth's climate. Students can also work through the content of the entire module called Carbon Connections which includes numerous models and interactives to gain a deeper understanding of the role of carbon in the climate system.

EarthViewer (iPad or Android) or Chrome browsers: Students explore the co-evolution of the geology and biology found on Earth to develop arguments from evidence for the co-evolution of geology and biology found on Earth. If iPads, Androids, or Chrome browsers are not available, similar interactives may be found at this link, and this link.

Career Readiness, Life Literacies, & Key Skills

TECH.9.4.12.CT.3	Enlist input from a variety of stakeholders (e.g., community members, experts in the field) to design a service learning activity that addresses a local or global issue (e.g., environmental justice).
TECH.9.4.12.CT.4	Participate in online strategy and planning sessions for course-based, school-based, or other project and determine the strategies that contribute to effective outcomes.
TECH.9.4.12.GCA.1	Collaborate with individuals to analyze a variety of potential solutions to climate change effects and determine why some solutions (e.g., political. economic, cultural) may work better than others (e.g., SL.11-12.1., HS-ETS1-1, HS-ETS1-2, HS-ETS1-4, 6.3.12.GeoGI.1, 7.1.IH.IPERS.6, 7.1.IL.IPERS.7, 8.2.12.ETW.3).
TECH.9.4.12.IML.2	Evaluate digital sources for timeliness, accuracy, perspective, credibility of the source, and relevance of information, in media, data, or other resources (e.g., NJSLSA.W8, Social Studies Practice: Gathering and Evaluating Sources.
TECH.9.4.12.IML.3	Analyze data using tools and models to make valid and reliable claims, or to determine optimal design solutions (e.g., S-ID.B.6a., 8.1.12.DA.5, 7.1.IH.IPRET.8).
TECH.9.4.12.IML.4	Assess and critique the appropriateness and impact of existing data visualizations for an intended audience (e.g., S-ID.B.6b, HS-LS2-4).
TECH.9.4.12.IML.5	Evaluate, synthesize, and apply information on climate change from various sources appropriately (e.g., 2.1.12.CHSS.6, S.IC.B.4, S.IC.B.6, 8.1.12.DA.1, 6.1.12.GeoHE.14.a, 7.1.AL.PRSNT.2).
TECH.9.4.12.IML.6	Use various types of media to produce and store information on climate change for different purposes and audiences with sensitivity to cultural, gender, and age diversity (e.g., NJSLSA.SL5).
TECH.9.4.12.IML.7	Develop an argument to support a claim regarding a current workplace or societal/ethical issue such as climate change (e.g., NJSLSA.W1, 7.1.AL.PRSNT.4).

Interdisciplinary Connections/Companion Standards

LA.RST.11-12.1	Accurately cite strong and thorough evidence from the text to support analysis of science

	and technical texts, attending to precise details for explanations or descriptions.
LA.WHST.11-12.2	Write informative/explanatory texts, including the narration of historical events, scientific procedures/experiments, or technical processes.