How the KTFR Curriculum Aligns with the Science Standards

As science curriculum, KTFR is strongly aligned with the national and state science standards for grades 5/6 and 9. KTFR also employs a 3-D Approach, described in the National Research Council's (NRC) *Framework* as their "vision of what it means to be proficient in science". The framework rests on a view of science as both a body of knowledge and an evidence-based, model and theory building enterprise that continually extends, refines, and revises knowledge. It presents three dimensions that will be combined to form each standard:

Dimension 1 = Science and Engineering Practices (SEPs)

ALL of the SEPs are integrated into the KTFR teaching/learning model.

1. Asking questions (for science) and defining problems (for engineering)
2. Developing and using models
3. Planning and carrying out investigations
4. Analyzing and interpreting data
5. Using mathematics and computational thinking
6. Constructing explanations (for science) and designing solutions (for engineering)
7. Engaging in argument from evidence
8. Obtaining, evaluating, and communicating information.

Dimension 2 = Cross Cutting Concepts

The crosscutting concepts begins with two concepts that are fundamental to the Nature of Science (NoS)—Patterns and Cause & Effect, which, along with Systems Thinking and Change Over Time, are the organizing principles of the KTFR curriculum.

1. **Patterns.** Observed patterns of forms and events guide organization and classification, and they prompt questions about relationships and the factors that influence them.

2. **Cause and effect:** Mechanism and explanation. Events have causes, sometimes simple, sometimes multifaceted. A major activity of science is investigating and explaining causal relationships and the mechanisms by which they are mediated. Such mechanisms can then be tested across given contexts and used to predict and explain events in new contexts.

3. **Scale, proportion, and quantity**. In considering phenomena, it is critical to recognize what is relevant at different measures of size, time, and energy and to recognize how changes in scale, proportion, or quantity affect a system's structure or performance.

4. **Systems and system models.** Defining the system under study—specifying its boundaries and making explicit a model of that system—provides tools for understanding and testing ideas that are applicable throughout science and engineering.

5. **Energy and matter.** Flows, cycles, and conservation. Tracking fluxes of energy and matter into, out of, and within systems helps one understand the systems' possibilities and limitations.

6. **Structure and function.** The way in which an object or living thing is shaped and its substructure determine many of its properties and functions.

7. **Stability and change.** For natural and built systems alike, conditions of stability and determinants of rates of change or evolution of a system are critical elements of study.

Dimension 3: Disciplinary Core Ideas (DCI)

Disciplinary ideas are grouped in four domains: the physical sciences; the life sciences; the earth and space sciences; and engineering, technology and applications of science.

The DCI foci of the KTFR curriculum are 1) Earth's Systems (ESS), with specific emphasis on Weather and Climate and Human Impact on the Environment, and 2) Engineering, Technology, Science, and Society (ETS).

Here's the specific alignment/designation of the KTFR curriculum with SC State Science Standards:

Earth's Systems – ESS2

- **ESS2.D: Weather and Climate /** Current models predict that, although future regional climate changes will be complex and varied, average global temperatures will continue to rise. The outcomes predicted by global climate models strongly depend on the amounts of human-generated greenhouse gases added to the atmosphere each year and by the ways in which these gases are absorbed by the ocean and biosphere. Hence the outcomes depend on human behaviors as well as on natural factors that involve complex feedback among Earth's systems.

ESS3: Earth and human activity

- **ESS3-1. Construct an explanation based on evidence for how the availability of natural resources and occurrence of natural hazards have influenced human activity.**
  Clarification Statement: Examples of key natural resources could include access to fresh water (such as rivers, lakes, and groundwater), regions of fertile soils such as river deltas, and high concentrations of minerals and fossil fuels. Examples of natural hazards can be from interior processes (such as volcanic eruptions and earthquakes), surface processes (such as tsunamis, mass wasting, and soil erosion), and severe weather (such as hurricanes, floods, and droughts).

- ESS3.B: Natural Hazards / Natural hazards and other geologic events have shaped the course of human history by destroying buildings and cities, eroding land, changing the course of rivers, and reducing the amount of arable land. These have significantly altered the sizes of human populations and have driven human migrations. Natural hazards can be local, regional, or global in origin, and their risks increase as populations grow.

- ESS3.C: Human Impacts on Earth Systems / When the source of an environmental problem is understood, human activities can be regulated to mitigate impacts.

- ESS3.D: Global Climate Change / Impacts of climate change--for example, increased frequency of severe storms due to ocean warming– have begun to influence human activities. Through computer simulations and other studies, important discoveries are still being made about how the ocean, the atmosphere, and the biosphere interact and are modified in response to human activities, as well as to changes in human activities. Thus, science and engineering will be essential both to understanding the possible impacts of global climate change and to informing decisions about how to slow its rate and consequences for humanity as well as for the rest of the planet.

Engineering, Technology, Science, and Society (ETS).

ETS1.A: Defining and Delimiting an Engineering Problem
Humanity faces major global challenges today, such as the need for supplies of clean water and food or for energy sources that minimize pollution, which can be addressed through engineering. These global challenges also may have manifestations in local communities.

ETS1.B: Developing Possible Solutions When evaluating solutions, it is important to take into account a range of constraints, including cost, safety, reliability, and aesthetics, and to consider social, cultural, and environmental impacts. Testing should lead to improvements in the design through an iterative procedure.

ETS2.B: Influence of Engineering, Technology, and Science on Society and the Natural World Engineers continuously modify these technological systems by applying scientific knowledge and engineering design practices to increase benefits while decreasing costs and risks. Analysis of costs and benefits is a critical aspect of decisions about technology.