TO: P-12 Education Committee

FROM: Ken Wagner

SUBJECT: New York's Statewide Strategic Plan for Science and P-12 Science Learning Standards

DATE: October 10, 2014

AUTHORIZATION(S):

SUMMARY

Item for Discussion

Department staff will provide an update on New York State's Statewide Strategic Plan for Science and a timeline for approval of this strategic plan and the consideration of science standards by the Board of Regents.

Background Information

The current New York State Learning Standards for Mathematics, Science, and Technology (MST) were adopted by the Board of Regents in March 1996. In the years immediately following, core curriculum resource guides were develop for elementary-level science (grades K-4), intermediate-level science (grades 5-8), and the commencement-level sciences including chemistry, Earth science, living environment, and physics.

The standards document includes seven standards. Standards 1, 2, 6, and 7 are considered the process standards and are common across the three content areas of mathematics, science, and technology. Standards 3, 4, and 5 are the content standards for mathematics, science, and technology, respectively. Each standard is further specified by several key ideas. Key ideas are further developed by performance indicators that are written for each grade band – elementary, intermediate, and commencement.

Each core curriculum resource guide includes the pertinent standards, key ideas, and performance indicators for each grade band in grades K-4 and grades 5-8, and for each specific discipline – chemistry, Earth science, living environment, and physics – at

the commencement level. The performance indicators included in each core curriculum resource guide are detailed by using major understandings.

Standard 3 was replaced with the New York State P-12 Common Core Learning Standards for Mathematics when adopted in July 2010 by the Board of Regents. The remaining MST standards, key ideas, and performance indicators continue to guide curriculum development, classroom instruction, and assessment in the sciences and in technology education.

In September 2011, New York State volunteered to serve and was selected by Achieve as a Lead State Partner in the development of the Next Generation Science Standards (NGSS), which are based on *A Framework for K–12 Science Education* (2012) developed by the National Research Council. In the role of Lead State Partner, the Department agreed to form a Statewide Leadership Team representing New York's science education stakeholders, provide feedback at various stages in the development of the NGSS, and give the final published version (April 2013) of the NGSS serious consideration for adoption as New York State's science learning standards.

These standards, and several supporting documents explaining the structure of the NGSS and a number of appendices, are accessible online at http://www.nextgenscience.org/next-generation-science-standards.

In April 2013, the Board of Regents discussed a New York State Standards Evaluation Tool developed by Department staff with input from science education stakeholder groups including the Science Content Advisory Panel, the Statewide Leadership Team, and representatives of the NYS Science Education Consortium (see Appendix A for the members of these groups). This standards evaluation tool included key criteria from standards evaluation documents developed by the Fordham Institute, the College Board, and the Massachusetts Department of Education. These criteria were used to analyze the merits of the NGSS and the current New York State Science Learning Standards (NYSSLS) in a side-by-side comparison. This evaluation tool was converted to a survey and posted on the Department's website in July 2013 to gather quantitative and qualitative feedback from the public at large.

In March 2014, the Board of Regents discussed the quantitative feedback that was collected from the survey. Respondents rated the NGSS statistically higher in 11 out of 21 criteria and rated the current New York State Science Learning Standards (NYSSLS) statistically higher in 6 out of 21 criteria. There are 4 criteria where the differences between the NGSS rating and the NYSSLS rating were not statistically significant. Further analysis of the quantitative data shows that both sets of standards have strengths and weaknesses when compared to the set of criteria used in the survey.

Statewide Strategic Plan for Science

The Statewide Strategic Plan for Science (see Appendix B) was developed by Department staff in collaboration with the Science Content Advisory Panel, the Statewide Leadership Team, and representatives of the NYS Science Education Consortium to guide a comprehensive approach toward improving P-12 science education statewide, while specifically addressing a mission and vision that incorporate six critical components simultaneously – Standards, Curriculum, Professional Development to Enhance Instruction, Assessment, Materials and Resource Support, and Administrative and Community Support. The six critical components are each equally important, and all six must be considered simultaneously during all stages of implementation. Achieving the mission is dependent upon achieving each of the goals of each of the six critical components.

The Statewide Strategic Plan for Science will be a significant aid if the Board of Regents elects to adopt and implement new or updated P-12 science learning standards:

- The mission statement describes the desired result for science education and provides a rationale and justification for the plan's existence.
- The vision statement describes how the mission will be achieved.
- The six critical components, each enhanced by a single goal, focus the vision.
    - Each goal is supported by a number of objectives, which are achieved by successfully completing a number of discrete activities.
- The activities include strategies:
    - to engage stakeholders such as parents and other community members, business and industry, informal education groups, institutes of higher education, and P-12 districts and schools in each of the six critical components,
    - to address the requisite professional development to align instructional practices with new P-12 science learning standards,
    - to examine the needs and program requirements for pre-service educators of science, and
    - to review policies and regulations related to student engagement with natural phenomena and authentic learning experiences.

Stakeholders' Support

In September 2013, the New York State Science Education Consortium, a group consisting of representatives from many of the science education professional associations of New York State, distributed their Position Paper on Next Generation Science Standards to members of the Board of Regents, Department staff, and the general public. This position paper (Appendix C) outlines the Consortium's stance with regard to adopting a new set of science learning standards for New York State.

During their Science Summit XIII held in July 2014, Consortium representatives presented recommendations to Department personnel for consideration as the

Department continues to deliberate the future of P-12 science education in New York State, including the following:

- Present the Board of Regents with the Statewide Strategic Plan for Science in the fall of 2014 as an item for discussion,
- Recommend that the Board of Regents adopt a revised version (based on feedback received from the general public, as appropriate) of the Statewide Strategic Plan for Science and authorize the development of a New York State version of the NGSS in early 2015, and
- Present the Board of Regents with a New York State version of the NGSS for their adoption in early 2016.

The Consortium's recommendations, their September 2013 position paper, and specific quantitative and qualitative feedback from the public survey (*Comparing Current NYS Science Learning Standards and the Next Generation Science Standards to Certain Criteria*) were shared, reviewed, and discussed with members of the Science Content Advisory Panel and the Statewide Leadership Team. Participants in these discussions support disseminating the Statewide Strategic Plan for Science to the public at large for review and comment. They also advocated the development of a new set of New York State science learning standards that unify the existing New York State Science Learning Standards and the NGSS, as appropriate.

To date, California, Delaware, Illinois, Kansas, Kentucky, Maryland, Nevada, New Jersey, Oregon, Rhode Island, Vermont, Washington, and Washington, D.C. have adopted the NGSS as their state science learning standards. Of these thirteen jurisdictions, eleven served as lead state partners. Only one state, Oklahoma, has adopted a new set of science learning standards that are an adaptation of the NGSS. Other states, including Massachusetts, South Dakota, and Utah, are in the early stages of developing and adopting an adaptation of the NGSS as their state science learning standards. Some states, including South Carolina, Texas, and Wyoming, have indicated they will not be considering the NGSS as part of their state's science learning standards adoption process.

The quantitative and qualitative feedback collected from the public survey indicated that the current New York State science learning standards and the NGSS have strengths and weaknesses. Discussions with science education stakeholders reaffirm this feedback. A new set of science learning standards developed by New York State science education stakeholders that unifies the strengths of the NGSS, the current New York State Science Learning Standards, and the work that has been done in other states will best serve the needs of New York State's students. A new set of science learning standards developed by New York State science education stakeholders has the potential to earn overwhelming support from the field and lead to a smooth transition from adoption to implementation guided by the Statewide Strategic Plan for Science.

Recommendation

It is recommended that the Board of Regents direct Department staff to post a draft of the Statewide Strategic Plan for Science for public comment from October – November 2014, review comments received during the public comment period, incorporate comments into the Statewide Strategic Plan for Science as appropriate, and present a final version to the Board for adoption in January 2015.

It is also recommended that the Board authorize Department staff to move forward with a process to update and develop New York State science learning standards that unify the existing New York State Science Learning Standards and the NGSS, as appropriate, and propose these new science learning standards for adoption in January 2016.

Appendix A: Membership in New York's Statewide Science Leadership and Advisory Groups

Statewide Leadership Team (SLT) - *convened by SED; provided feedback to Achieve at various stages of NGSS*	Organization
Sheila Appel	IBM
Margaret Ashida	Battelle/STEMx
Kelly Baudo	Buffalo Public Schools
Nicole Bobel	Buffalo Public Schools
Greg Borman	CUNY
Michael Carpenter	SUNY Albany College Nanoscale Science and Engineering
Jackie Carrese	Capital Area Science Supervisors Association
Michael Chan	Rochester City School District
Natasha Cooke-Nieves	American Museum of Natural History
Linda Curtis-Bey	NYC Department of Education
Joseph Dragone	Ballston Spa Central School District
Kim Drake Hyland	Guilderland Central School District
Don Duggan-Haas	Paleontological Research Institution
Linda Gentiluomo	Schenectady City School District
Odalys Igneri	NYC Department of Education
Michael Jabot	SUNY Fredonia
David Kanter	New York Hall of Science
David Marmor	NYC Department of Education
Judy Mayer	Yonkers Public Schools
Denise McNamara	NYC Department of Education
Julie Nucci	Cornell University
William Ottman	Syracuse City School District
Fred Pidgeon	Science Teachers Association of New York State
Charlene Rydgren	Malone Central School District
Thomas Shiland	Saratoga Springs City School District
Jan Stark	Port Jervis City School District
Henry Strada	NYS Technology and Engineering Educators Association
Mark Vaughn	Corning Incorporated
Chuck Ver Straeten	New York State Museum/Geological Survey
Brian Vorwald	Science Teachers Association of New York State
Judy Wegman	Brighton Central School District
Ken White	Brookhaven National Laboratory
Kathy Wronski	Lyndonville Central School District

Science Content Advisory Panel (SCAP) - *convened by SED; advises on the revision and implementation of NYS science learning standards*	Organization
Lawrence R. Aaronson	Utica College
Marie Anderson	Kingston City School District
Jennifer Baxter	Palmyra-Macedon Central School District
Fernando Espinoza	SUNY Old Westbury
Karen Harris	Schodack City School District
Karen Huffman-Kelly	Genessee Community College
David Kanter	New York Hall of Science
Denise McNamara	NYC Department of Education
William Panaram	NYC Department of Education
Kate Perry	Robert C. Parker School
Shane Price	Lyndonville Central School District
Ann Rivet	Columbia University
Susan Sciglibaglio	Bethpage Union Free School District
Mark Vaughn	Corning Incorporated
Linda Weinberg	SUNY Delhi

NYS Science Education Consortium - *convened by consortium; combination of leaders from the 16 regional sections of STANYS and teacher professional organizations across the state*	Organization
John Augenstein	Science Council of New York City
Jackie Carrese	Capital Area Science Supervisors Association
John Cunninham	Science Council of New York City
Connie Duff	New York State Science Education Leadership Association
Steve Fielman	Science Teachers Association of New York State
Fran Hess	Science Teachers Association of New York State
Kathy Hoppe	Science Teachers Association of New York State
Mary Loesing	Long Island Science Education Leadership Association
Linda Padwa	Biology-Chemistry Professional Development Network
Fred Pidgeon	Science Teachers Association of New York State
Patricia Price	Higher Education Representative
Arnie Serotsky	Science Teachers Association of New York State, Co-Facilitator
Mary Thomas	Science Teachers Association of New York State
Bruce Tulloch	Facilitator
Brian Vorwald	Science Teachers Association of New York State

Appendix B: Statewide Strategic Plan for Science

Preamble

The Statewide Strategic Plan for Science serves as a planning and implementation guide to support newly adopted P-12 science learning standards. The strategic plan begins with mission and vision statements. The mission statement describes the desired result, and provides a reason for the plan's existence. The vision statement describes how the mission will be achieved. Six critical components – Standards, Curriculum, Professional Development to Enhance Instruction, Assessment, Materials and Resource Support, and Administrative and Community Support – each enhanced by a single goal, focus the vision. Each goal is supported by a number of objectives, which are achieved by successfully completing a number of discrete activities.

Considered in a broad sense, the six critical components are each equally important. One carries no more importance than another, and all six must be considered simultaneously at all stages of implementation. During specific stages of implementation, however, one or more of the six critical components may be deserving of more attention than the others, but the others must still be considered. Achieving the goal of each critical component is dependent upon achieving the goals of the other critical components. Achieving the mission is dependent upon achieving each of the goals of each of the six critical components.

The mission of the Statewide Strategic Plan for Science can only be realized if all of the stakeholders are involved in its implementation. Creating a Statewide learning community involves all stakeholders including, but not limited to, students, parents, other caregivers, teachers, counselors, other supporting educators/mentors, informal educators, administrators, college professors, members of professional associations, institutes, and/or societies, business and industry professionals, and government officials. Each community member is invited and expected to participate in achieving the mission. Collaboration and participation of all community members, as their expertise shall warrant, will provide the most effective avenue to achieving the mission.

In the plan, the term STEM refers to both the individual disciplines associated with science, technology, engineering, and mathematics and the connections between these disciplines.

Mission

Create a Statewide learning community to enhance science education and improve student achievement of the New York State science learning standards leading to career and college readiness and a scientifically literate population capable of addressing the needs of society, participating in a global economy, and sustaining the physical and living environment.

Vision

Ensure the teaching and learning of science for all P-12 students by providing equitable access to exemplary teachers, science curriculum programming, instructional practices, and standards-based assessments that are reflective of research and best practices, along with quality resources and support from stakeholders at large.

Standards

Goal: Adopt new P-12 NYS science learning standards and 5-year strategic plan.

Objective: Direct the review, revision, and adoption process for identifying new P-12 NYS science learning standards.

Activities:

- Develop a 5-year, statewide strategic plan for science for adoption by the Board of Regents.
- Develop and post a public survey to gather stakeholder feedback on comparing current NYS science learning standards and nationally developed Next Generation Science Standards (NGSS) to research-based standards evaluation criteria.
- Engage science education stakeholders to analyze feedback from the public survey.

Objective: Determine the core science content, conceptual understandings, and practices for all students P-12 that develops scientifically literate citizens who are better prepared to pursue college and/or career pathways.

Activities:

- Convene committees of stakeholders to review feedback from the public survey, other pertinent data, and current research in science and science education, as well as other international, national, and state standards documents.
- Develop a recommendation to the Board of Regents regarding the adoption of a revised set of the current NYS science learning standards, the adoption of a new set of P-12 NYS science learning standards incorporating the tenets of the Framework for K-12

Science Education, the adoption of a new set of P-12 NYS science learning standards influenced by the NGSS, or the adoption of the NGSS.

- Develop cross-content area benchmarks for use both within and across P-12 grade levels to support horizontal and vertical articulation between the science disciplines and other content areas.
- Identify convergences with engineering, technology, the New York State P-12 Common Core Learning Standards for Mathematics, and the New York State P-12 Common Core Learning Standards for English Language Arts and Literacy.

Objective: Implement and sustain the 5-year strategic plan for transitioning to the new P-12 NYS science learning standards.

Activities:

- Develop a reasonable timeline for the adoption of and transition to implementation of the new P-12 NYS science learning standards.
- Secure funding to support and sustain the implementation process at the State, regional, and local levels.
- Ensure that the six critical components – Standards, Curriculum, Professional Development to Enhance Instruction, Assessment, Materials and Resource Support, and Administrative and Community Support – of the 5-year strategic plan are addressed concurrently during the implementation process.

Curriculum

Goal: Provide opportunities that are reflective of research and best practices for P-12 students to engage with scientific phenomena through implementation of innovative science curriculum programming that fosters learning, deep understanding, and application of core science content, conceptual understandings, and practices.

Objective: Survey current research pertaining to teaching and learning in science, science education, and cognitive science to develop relevant curriculum guidance and resources.

Activities:

- Explore, identify, and provide access to pertinent research.
- Develop articulated P-12 guidance to support curriculum development and implementation aligned to the new P-12 NYS science learning standards.
- Provide funding opportunities for equitable development and/or adoption of exemplary science curriculum programming.
- Provide funding opportunities for equitable implementation and evaluation of exemplary science curriculum programming at the regional and local levels.
- Align and incorporate relevant connections to engineering, technology, the New York State P-12 Common Core Learning Standards for Mathematics, and the New York State P-12 Common Core Learning Standards for English Language Arts and Literacy.
- Review and update curriculum guidance and resources to be reflective of changes in instructional technology, content, and best educational practices, emphasizing active engagement in STEM.

Objective: Build the capacity of regional centers and local school districts to implement curriculum and instructional programs that are based on the new P-12 NYS science learning standards.

Activities:

- Support the implementation of exemplary, data-informed science curriculum programming and instructional materials, using cross-curricular connections from engineering, technology, the New York State P-12 Common Core Learning Standards for Mathematics, and the New York State P-12 Common Core Learning Standards for English Language Arts and Literacy that strengthen, support, and reinforce the development of scientific literacy.
- Leverage funding opportunities for partnerships and collaborations of science education stakeholders for the development, dissemination, and implementation of local and regional curriculum programming.
- Engage education stakeholders with expertise in various disciplines to support local and regional development, dissemination, and

implementation of curriculum based on the new P-12 NYS science learning standards.

- Create opportunities that bring students into contact with working scientists, mathematicians, and engineers through innovative curriculum design, internships, and mentorships with institutes of higher education and/or business and industry partners.

Objective: Incorporate the use of technology to expand the development, dissemination, and implementation of curriculum and instructional resources to broaden accessibility.

Activities:

- Leverage existing and seek new funding sources to support the use of technology to develop, disseminate, and implement science curriculum and instructional resources through various delivery platforms.
- Utilize multiple platforms to access exemplary curriculum and instructional resources.
- Build student resources by establishing community-based programs that provide relevant STEM applications in science curriculum and instructional programs.

Professional Development to Enhance Instruction

Goal: Initiate, build, and sustain collaborations and partnerships to provide specific and focused professional development to support the teaching and learning of core science content, conceptual understandings, and practices P-12.

Objective: Provide opportunities for local educational agencies to collaborate and partner with STEM education stakeholders to develop and implement effective professional development models that are based upon the new P-12 NYS science learning standards.

Activities:

- Establish networks of stakeholders in STEM education to provide professional development that enhances the development, dissemination, and implementation of curriculum, instructional and assessment materials, and other resources.
- Engage local, state, and national professional and science education associations to lead and sustain STEM-related professional development opportunities for face-to-face and online collaboration.
- Build the capacity of interested business and industry experts to effectively partner with local educational agencies by promoting pertinent professional learning opportunities and resources.
- Target funding opportunities that support partnerships between business and industry, institutes of higher education, professional and science education associations, local education agencies, and

other stakeholders to sustain professional development for teachers and leaders in science.

- Promote institutes, courses, and/or workshops that enhance the teaching and learning of the individual disciplines associated with science, technology, engineering, and mathematics and the connections between these disciplines.
- Create access to new and/or existing, online, on-demand venues for specific and focused professional development.

Objective: Increase teacher and leader participation and engagement in professional development opportunities that are based upon the new P-12 NYS science learning standards to build subject knowledge and pedagogical-content knowledge in the sciences by leveraging the expertise of science education stakeholders.

Activities:

- Design opportunities to coordinate professional development that articulates collaborations and partnerships across P-16.
- Target annual professional development in science that builds specific subject knowledge and pedagogical-content knowledge toward fulfilling the 175 hours required for maintenance of certification.
- Provide funding opportunities for teachers and leaders to participate in sustained, online or on-site professional development institutes, professional learning communities, courses, and/or workshops during the school year.
- Incorporate career-ladder incentives for teachers and leaders to provide professional development sessions and engage in professional development opportunities that are related to STEM education.
- Identify or develop and implement a needs assessment to determine the focus of future professional development opportunities.
- Create professional development opportunities that bring teachers and leaders into contact with working scientists, mathematicians, and engineers through internships and mentorships with peer teachers, institutes of higher education, and/or business and industry partners.

Objective: Include components of science and engineering practices for pre-service STEM teacher and leader preparation programs and in continuing professional development opportunities that are based upon the new P-12 NYS science learning standards for in-service teachers and leaders.

Activities:

- Build teacher resources by establishing community-based programs that provide relevant STEM applications in science curriculum and instructional programs.

- Create or access professional development opportunities that focus on the integration of science and engineering practices in STEM courses.
- Articulate collaborations and partnerships between STEM stakeholders that support curriculum programming and instructional practices that are better aligned to college and career expectations.
- Establish partnership programs between local education agencies and institutes of higher education to foster innovative comprehensive approaches that enhance pre-service and in-service teaching and learning of science and engineering practices.

Assessment

Goal: Support the development of assessments at the state, regional, and local levels that measure student achievement of all new P-12 NYS science learning standards, and use the data resulting from these assessments to enhance teaching and learning.

Objective: Explore established and contemporary science assessment models at the international, national, state, regional, and local levels to implement changes in the P-12 science assessment system that are reflective of the new NYS P-12 science learning standards.

Activities:

- Convene science education stakeholders to review and evaluate New York State's current assessment system for the sciences P-12.
- Collaborate between states to discuss and/or develop science assessments that have common blueprints.
- Propose a P-12 science assessment system that reflects the core science content, conceptual understandings, and practices that are included in the new P-12 NYS science learning standards.
- Develop and recommend an implementation timeline that is based on the Board of Regents' decision regarding the new P-12 NYS science learning standards and assessment system.

Objective: Understand and use relevant student achievement data from State science assessments to initiate data-driven professional development, curriculum, instruction, and assessment.

Activities:

- Collaborate with science education stakeholders statewide, regionally, and locally to provide professional development for teachers and leaders that is focused on understanding and analyzing student achievement data for improving science teaching and learning.
- Provide professional development opportunities for teachers and leaders to better understand the intent and design of an assessment

system that is aligned to the new P-12 NYS science learning standards.

- Provide professional development on the use of student achievement data to foster the development of formative assessments at the local and regional levels.
- Continue to develop and administer valid and reliable State science assessments to drive professional development to improve teaching and student achievement.

Materials and Resource Support

Goal: Support regular and substantive teaching and learning of core science content, conceptual understandings, and practices through scientific inquiry and authentic engagement with natural phenomena by providing models of effective systems management and dissemination of science materials.

Objective: Create new and identify existing science material centers (regional, district, school-based) and related resources to support the equitable access and implementation of exemplary, cost-effective curriculum programming and instructional materials that are aligned to the new P-12 NYS science learning standards.

Activities:

- Seek funding opportunities to acquire equipment, materials, and supplies to support the development, implementation, and sustainability of P-12 science curriculum and instructional programming at the local and regional levels.
- Identify new or use existing funding streams to support facilities planning to provide physical space that is conducive to teaching and learning in state-of-the-art classrooms and laboratories.
- Develop collaborations and partnerships to promote and support comprehensive systems for the development, implementation, and sustainability of science materials and resources.
- Seek funding opportunities for instructional technologies that support core science and engineering content, conceptual understandings, and practices.

Objective: Build the capacity of local educational agencies, higher education institutions, business and industry partners, and other profit and nonprofit organizations to connect teachers and students to relevant, real-world science applications that are aligned to the new P-12 NYS science learning standards.

Activities:

- Develop partnerships between STEM stakeholders and school districts that collaborate to provide education outreach for science materials and other logistical support.

- Provide mentorships and research opportunities for teachers and students through incentives to build partnerships between business and industry, higher education institutions, and/or other STEM stakeholders (i.e., museums, nature centers, community organizations, etc.).
- Provide incentives for outreach opportunities and technical support for laboratory experiences and rentals of high-tech research equipment.
- Capitalize on the regional and local capacity to offer distance learning and online courses through partnerships and grants.
- Investigate opportunities to expand access to science content through online resources.

Administrative and Community Support

Goal: Build the capacity to enhance science education and ensure career readiness by involving STEM stakeholder partnerships and alliances between school districts, institutions of higher education, science education professional organizations, business and industry, informal education organizations, government agencies, and the larger learning communities: local, regional, state, national, and international arenas.

Objective: Identify science education stakeholders to lead the development and continued growth of partnerships focused on comprehensive revitalization of science education.

Activities:

- Support collaborations with regional STEM hubs that provide access to various higher education faculty and business and industry experts and their facilities to raise awareness of real-world applications and opportunities in STEM college and career pathways.
- Engage key STEM stakeholders to serve as catalysts in the advancement and implementation process pertaining to NYS science education to build and sustain a STEM talent pipeline.
- Utilize informal (i.e., museums, nature centers, community organizations, etc.) and formal (i.e., P-12 schools, institutes of higher education, business and industry, research centers) STEM education stakeholders and their resources to promote and support new and existing innovative science education initiatives (i.e., fellowships, internships, mentorships, research opportunities).
- Identify models of effective collaborations between departments of science, technology, engineering, and mathematics and teacher education programs of institutes of higher education.
- Provide incentives for institutes of higher education to facilitate collaborations between departments of science, technology,

engineering, and mathematics and teacher education programs of institutes of higher education.
- Develop and implement career ladder incentives for teachers and administrators that build the leadership capacity and talent pool of STEM departments of school districts and in institutes of higher education.

Objective: Review, revise, and propose regulations that reflect engagement in innovative teaching and learning through authentic experiences with natural phenomena that lead to the achievement of the new P-12 NYS science learning standards by all students.

Activities:

- Solicit input from STEM education stakeholders, ensuring the involvement of experts from P-12 education, institutes of higher education, and business and industry in the advisement and recommendations for regulations addressing qualifications to teach science P-12.
- Convene science education stakeholders to re-examine the alignment of teacher certification P-12 to the structure of the new P-12 NYS science learning standards, the Framework for K-12 Science Education, and the NGSS.
- Re-examine pre-service program requirements to include multiple paths to acquire endorsements of specialization in science education P-12.
- Re-examine the current in-service professional development requirement (175 hours over 5 years) to recommend a minimum allocation of time toward teacher participation in science pedagogical content knowledge-based PD and the distribution of these hours over time.
- Review commissioner's regulations pertaining to science program and diploma requirements P-12 and consider amendments to reflect the knowledge and skills as consumers of scientific and technological information related to their everyday lives and enabling them to enter the colleges and/or careers of their choice.
- Ensure internal collaboration and consultation between various program offices within the NYSED to propose the requisite changes in regulations.

Objective: Leverage fiscal and human resources, through STEM education stakeholder partnerships to catalyze and sustain the revitalization of science education statewide, regionally, and locally.

Activities:

- Explore funding opportunities offered by both public and private sectors to establish STEM stakeholder partnerships that are focused on enhancing programs in STEM education by embracing models

that are similar to those used in the National Board Certification process.

- Re-evaluate the coordination, allocation, and distribution of state and federal funding streams to better support science education.
- Identify available grants to sustain the implementation of the new P-12 NYS science learning standards through partnerships within the State's established infrastructure, such as BOCES, museums, STEM Hubs, etc.

Objective: Enhance public relations to heighten the importance and strengthen the presence of P-12 science education in New York State.

Activities:

- Develop a statewide plan for improving communication with science stakeholders and the community at large about the benefits of STEM education.
- Develop a plan to build awareness regarding the importance of science education for citizenry and readiness for college and/or careers.
- Build support and enhance knowledge of the public and private sectors to promote effective implementation of science curriculum programming, instructional practices, and standards-based assessments that are aligned to the new P-12 NYS science learning standards.

Position Paper on Next Generation Science Standards

New York State Science Education Consortium

September, 2013

The New York State Science Education Consortium has reviewed and discussed the Next Generation Science Standards (NGSS). The Consortium recognizes the need for change in science education and views the NGSS as a promising vehicle for implementing that change. However, at the outset, the Consortium's position is that any significant reform in science education must be accompanied by review and revision to existing policies and regulations governing K-12 science education in New York State so that the reform can be enhanced rather than compromised. Assuming this policy and regulatory review and revision will be completed, the Consortium *conditionally* recommends adoption and implementation of the NGSS by the New York State Board of Regents and New York State Education Department with the following caveats:

- A New York State version of the NGSS must be wisely implemented with full funding to support the design and development of new state curriculum guidance documents and assessments and the provision of a robust professional development initiative.

- While the amount of disciplinary content in the NGSS is generally appropriate to meet *minimum* science literacy expectations for *all students*, there are some fundamental concepts and principles missing. For example, there are concepts and principles in the current state core curricula in Intermediate Level Science, Regents Earth Science, and Regents Living Environment that are not found in the NGSS but are important to learn if students are to become college and career ready. So, to a developmentally appropriate degree, these concepts and principles must be added to a New York State version of the NGSS and the derivative state curriculum guidance documents and assessments.

- The goals and performance expectations of the NGSS are necessary for all students but not sufficient for preparing students who intend to pursue professional careers in science, engineering, and/or technology. Therefore, the adoption and implementation of a New York State version of the NGSS must leave room for the development and existence

of upper level high school science courses that serve the pre-professional needs of this important population of students. These upper level courses include Regents Chemistry, Regents Physics, Advanced Placement science courses, International Baccalaureate science courses, and college-level science courses. These courses will include content that moves students towards achieving the NGSS but also include content at more advanced levels than NGSS.

- The adoption and implementation of a New York State version of the NGSS represents a paradigm shift in K-12 science education in our state and can only be successful if the following steps are taken:

  - Planning for implementation must include the significant and sustained involvement of New York State science teachers, science supervisors, teacher educators and the science educator professional associations.

  - New York State teachers of science and other science educators must be instrumentally involved in the development of the state's curriculum guidance documents, assessments, professional development initiatives, and other factors directly related to the implementation of a New York State version of the NGSS. While the state should take advantage of the regional and national work associated with the adoption of NGSS in other states, the expertise, contextual insights, and experience of its own science educators must be drawn upon to ensure a successful adoption.

  - If a New York State version of the NGSS is adopted by the Board of Regents, the timeline for K-12 implementation should give sufficient time for the field to become aware of the new standards, develop local and regional curricula aligned with new state curriculum guidance documents, and align instructional programs and local assessments with the new state science assessments.

  - Implementation of a New York State version of the NGSS will require a statewide, systemic, focused, and sustained professional development initiative to provide K-12 teachers of science with the knowledge and skills necessary to teach the New York State version of the NGSS effectively. Consortia of school districts and schools such as BOCES, the Big Five Cities, professional science educator

associations, institutions of higher education, business, and other stakeholders must be involved in the planning and monitoring of this initiative.

A thorough and successful implementation of a New York State version of the NGSS will require an ambitious and sustained initiative and the resources to support this initiative. If the Board of Regents is committed to implementing the recommendations of this position paper and aggressively seeking funding to support the initiative, then the New York State Science Education Consortium fully supports the adoption of a New York State version of the Next Generation Science Standards.

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