## Overview

**The National Science Education Standards address the essential elements of K-12 science laboratories:**
"The K-12 science program must give student access to appropriate and sufficient resources, including quality teachers, time, materials and equipment, adequate and safe space."

Building Officials and Code Administrators (BOCA), International Conference of Building Officials (ICBO), and Southern Building Code Congress International, Inc. (SBCCI) merged to form the International Code Council (ICC) to develop a single set of comprehensive and coordinated national model construction codes. The ICC codes, state and local building codes govern the building of schools in the U.S. Standards/regulations set forth by ANSI, NFPA, professional organizations, local school boards and state and local governments also mandate criteria for school facilities. State legislatures usually pass laws to determine the criteria and funding of school facilities or give this authority to State Boards of Education.

### LAWS GOVERNING FACILITIES AND EQUIPMENT

California and other states have extensive policies in their laws. Science teachers should take an active role in planning, furnishing and equipping their science facilities. The following original North Carolina sample regulations exemplify similar state statutes and serve as a model. An updated guide can be found at: https://www.dpi.nc.gov/districts-schools/district-operations/school-planning.

**North Carolina GS §115C-521. Check North Carolina Updated General Statutes (GS) for current changes. Erection of School Buildings**
(a) It shall be the duty of local boards of education to provide classroom facilities adequate to meet the requirements of North Carolina GS §115C-47(10) and §115C-301. Local boards of education shall submit their long-range plans for meeting school facility needs to the State Board of Education by January 1, 1988, and every five years thereafter. In developing these plans, local boards of education shall consider the costs and feasibility of renovating old school buildings instead of replacing them.

(b) It shall be the duty of the boards of education of the several local school administrative school units of the State to make provisions for the public school term by providing adequate school buildings equipped with suitable school furniture and apparatus. The needs and the costs of those buildings, equipment and apparatus, shall be presented each year when the school budget is submitted to the respective tax-levying authorities. The boards of commissioners shall be given a reasonable time to provide the funds which they, upon investigation, shall find to be necessary for providing their respective units with buildings suitably equipped, and it shall be the duty of the several boards of county commissioners to provide funds for the same.

**North Carolina GS §115C-522(c) Provision of Equipment for Buildings**
It shall be the duty of local Boards of Education and tax-levying authorities (County Commissioners) to provide suitable supplies for the school buildings under their jurisdictions. These supplies shall include necessary instructional supplies and equipment for teaching the sciences, in addition to instructional supplies for other areas of the school.

**References with information detailing criteria for science laboratory facilities in K-12 schools:**
- Fisher Science Education *Lab Construction and Renovation Guide* (Interactive)
- Flinn Scientific *Laboratory Design*
- National Science Teaching Association (NSTA) *NSTA Guide to School Science Facilities,* James T. Biehl, LaMoine L. Motz, and Sandra S. West. 1999.
- *NSTA Guide to School Science Facilities,* LaMoine L. Motz , James T. Biehl, and Sandra S. West. Second Edition, 2007.
- Charles A. Dana Center
- North Carolina Department of Public Instruction
- "Planning Guide for Maintaining School Facilities, *https://www.dpi.nc.gov/districts-schools/district-operations/school-planning*
- NSTA Safety Portal Resources, https://*www.nsta.org/topics/safety*

## NCDPI School Science Facilities Planner

### FOREWORD

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Science education comprises an essential component of the North Carolina Standard Course of Study. That document origionally set forth goals that can enable the student to become scientifically literate and have a substantial knowledge of the concepts, conceptual networks, and process skills that can equip him or her to continue to learn and think logically. It is widely recognized that a scientifically literate society is essential if this state and the nation are to successfully compete in an increasingly broad, complex and technological society.

As is the curriculum described in the North Carolina Course of Study, facilities that appropriately support safe and effective instruction in the sciences are essential to providing each student optimal opportunities for learning. A growing body of research shows positive student performance implications related to school climate and order—variables directly attributable, in part, to facilities design. Well-designed science facilities can enhance both the teacher's ability to teach and the success of the student's learning experience.

This publication describes science programs and facilities and is a supplement to the North Carolina Public School Facilities Guidelines. It is a resource that can assist design professionals to plan facilities that effectively meet the evolving needs of public schools in North Carolina. We hope you find it useful.

Note: A major change in the Science Facilities plan review process was implemented due to a recent General Statute requirement. As a result of this new legislation, in its March 2010 meeting, the N.C. State Board of Education approved the "Middle and High School Science Safety Standards" (Appendix "A" in the rear of this publication). This board policy requires that DPI, School Planning review and approve all Middle and High School Science projects for safety. This approval must be in place before these facilities can be occupied.

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## Introduction

### BACKGROUND AND OVERVIEW

Each school day nearly 1.45 million children enter classrooms in the public schools of North Carolina. Even for the youngest child, science is a vital part of the curriculum and is taught regularly throughout the year. Developmentally appropriate, integrated instruction in earth, life, and physical sciences follows the student through the conclusion of the public school experience. The design professional will face the challenge of melding necessary physical components that can support classroom and laboratory science instruction into a facility shared with programs and services in other curriculum and support areas. Provision for the child with special physical or educational needs presents additional and unique considerations to the design process for an integrated facility. The most effective facility design will reflect a marriage of sound program planning by school system personnel and knowledgeable, inventive application of design principles by the design professional and will embody flexibility sufficient to sustain current and emerging approaches to providing science instruction. These planning guidelines are intended to enhance that endeavor.

### SCIENCE EDUCATION

The mission of science education in the public schools is to ensure that all students become scientifically literate— that is, that they possess a substantial knowledge of concepts, conceptual networks, and process skills that enable continued learning and logical thinking. Program strands and goals for science education provide the basis for the curriculum and include (1) the nature of science, (2) science as inquiry, (3) science and technology (4) science in social and personal perspectives, and (5) science concepts. These program goals are the source for all science education objectives. The Science Curriculum is offered through integrated study of the identified program goals in the areas of earth, environmental, life, and physical science. Recent advances in science and technology are highlighted throughout. The student gains a broader and more comprehensive understanding of program goals as the grade level advances. From the student's earliest exposure, experiential learning is recommended. An experiential, inquiry-based instructional program is essential to student understanding of science at all levels, beginning with the lowest grades. In this way, science program goals are achievable by all students and can provide the student with a rewarding learning experience and a sense of accomplishment.

### USING THE FACILITIES PLANNER

This publication is intended as a reference document for designers of public school facilities.

Its purpose is to provide descriptions of school science programs and the facilities that can support them. It is neither comprehensive nor all-inclusive, but provides an initial understanding of the nature and purposes of instructional programs around which facility designs may evolve. The guidelines supersede neither state nor local codes or regulations, nor federal or state legislation regarding building design and construction, access, safety, or other pertinent issues. **Note that General Statute 115C-81.4 and 115C-521(C1) requires the State Board of Education to approve middle and high school science facility plans for safety (through DPI, School Planning Section) before a certificate of occupancy is applied for.** Some aspects of all science programs and facilities are similar in nature and are described in the introductory portions of this guide. Subsequent sections focus on the peculiar requirements of individual courses or program areas. Sample floor plans supplement and clarify printed descriptions and are not intended for direct replication within facility designs. Because it is a policy of the National Science Teaching Association that classes greater than 24 students in size pose a potential safety risk, sample plans shown in this guide are designed accordingly. Local program requirements and available state and local resources should be considered in determining student capacity for actual facilities design. As a design takes shape, it is likely that additional, more detailed information will be needed about the programs, equipment, and purposes that will function within the facility. Several resources that should prove useful are provided in the Additional Resources section near the end of the publication. In addition, staff consultants with the Science Education Section of the North Carolina Department of Public Instruction are available to discuss areas of concern.

## Facilities Design

Designing school facilities challenges the collective planning skills and creativity of educators and design professionals. Providing desirable learning environments for a variety of science education programs can introduce particularly complex issues into that collaboration. At least two unique characteristics of science education facilities emphasize the importance of good design decisions. First is the high cost of space and equipment, relative to that for most other teaching stations in a school. The required volume of space for laboratories will significantly exceed that for a lecture setting, while equipment costs may be many times greater. Second is the inflexibility of some laboratory designs. Facilities may require relatively large floor spaces with special infrastructure. Such facilities may be less flexible, in that they can be very expensive to renovate and poorly located for some other uses. In general, laboratories can more easily be converted to other types of laboratories than spaces for purely classroom use. This section identifies design considerations that are common to most school science facilities. Requirements unique to specific facilities are described in a subsequent portion of the publication.

### CLASSROOMS

Each program will require access to classroom space sufficient for anticipated student enrollments. Classrooms will serve as assembly areas where students may receive group instruction, plan, research, use audiovisual materials, and access computer resources. In situations where several laboratories are located in proximity and classrooms are shared, a small assembly area may be considered for each laboratory.

Most elementary science will be taught in the regular classroom, which should contain a minimum of from 1,000 to 1,200 $ft^2$. A designated multi-discipline project room of approximately 1,000 $ft^2$, to serve more than one program (e.g., science, art, math, social studies), can enhance the elementary science program. National Science Teaching Association (NSTA) recommends 1,080 $ft^2$ for a multiple use elementary multiple-use science classroom or 45 $ft^2$ per student. A separate, lockable storage area for each discipline should be provided.

Regular classrooms for grades six through eight should contain a minimum of from 850 to 1,000 $ft^2$; regular classrooms for grades nine through twelve a minimum of from 750 to 850 $ft^2$. If a classroom is combined with a laboratory, significant additional area is required. Classrooms smaller than 1,000 $ft^2$ should not exceed a 3:2 length-to-width ratio, with a minimum width for any such space of 24 ft. The National Science Teaching Association (NSTA) recommends 1,440 $ft^2$ for a multiple use middle or secondary multiple-use science classroom or 60 $ft^2$ per student.

The Typical classroom space should have dry marker and tack boards, individual student tables and chairs, a demonstration table, and a teacher desk and chair. A conference table for six should be considered, and should be separated from the classroom by a transparent partition. Ample storage for audiovisual equipment and materials, printed instructional resources, and teacher and student files should be provided. A minimum of one permanently mounted television monitor or projector should be provided, as should cabling and outlets for computers and other communications systems. Room size should be increased by 15 to- 20 $ft^2$ per computer, and future usage of computers and other technology should be considered in sizing and