

NSELA Safety Position Statement Occupancy Loads in School Science/STEM Laboratories

Introduction:

The academic challenges for science leadership have increased with the redirection of science education over the past two decades. The 1995 National Science Education Standards, the 2013 Next Generation Science Standards and A Framework for K-12 Science Education were created and designed to establish goals for achievement that are appropriate for all members of the science education community to embrace and foster in the 21st Century. During the last twenty years in science education, major curriculum initiatives and projects have been developed in efforts to improve the teaching and learning of science/STEM in schools. All of these projects have focused on the premise that students need to do science/STEM, not simply read about it! As a result, the philosophy of doing hands-on, inquiry and process-based science/STEM education has had an effect on curriculum revisions and school building projects across the nation.

This approach to science education, in addition to the following items, continues to drive the need for new construction and renovations of school science laboratories and makerspaces:

1. Increased student populations,
2. Adoption of additional science graduation requirements,
3. Increased college level science/STEM offerings at the high school level
4. Efforts to meet the national priority of science and STEM education

Through the use of formal laboratory facilities and classrooms equipment for science, teachers are better able to foster both qualitative and quantitative data acquisition and skill development in efforts to figure out the world around them, and their understanding and learning of science/STEM.

Statement:

Science leaders are also being challenged to help meet legal aspects for formal academic science laboratories (primarily secondary levels) and classrooms equipment for science activities (primarily elementary level). The "duty or standard of care" required for each student by science teachers acting as a reasonable person must be addressed in helping to make laboratories safer. There is acknowledgement of the limitations of insurance in denying coverage for reckless and intentional acts by science educators. There is also the potential for individual liability for acts outside the course and scope of the employment. In addressing the occupancy safety issues, the items for consideration should include:

1. The number of laboratory occupants makes a significant difference in traffic flow, trip/slip fall hazards and individual monitoring.
2. Increasing the number of laboratory occupants in a science/STEM laboratory increases the likelihood of accidents.
3. Higher pupil/teacher ratio over the 24-student maximum professional standard constitutes a threat to science/STEM laboratory safety based on current research.
4. Exceeded occupancy loads challenge a teacher to safely handle, transport and use laboratory chemicals and equipment, thereby creating an unsafe working environment.
5. Exceeded occupancy loads can also increase classroom management issues, which in turn contribute to unsafe conditions.

One of the greatest challenges for science educators is to address the professional quasi-legal and legal occupancy load standards for the purpose of establishing and maintaining a safer teaching and learning environment. Based on current research, a maximum class size of 24 students is the academic and safety expectation for school science/STEM laboratories. This is providing the legal occupancy load standard is met which approximates 50 sq. ft. net/occupant in a lab and 60 sq. ft. net/occupant in a "clab" or combination lecture/laboratory. Actual occupancy load is determined by the local authority having jurisdiction (e.g., fire marshal) based on factors such as square footage, type of furniture, utilities, chemical hazards, energy sources, sprinkler system, and number of exits.

In order to address professional quasi-legal and safety standards based legal occupancy loads for laboratories, the National Science Education Leadership Association strongly recommends the following:

A. For new science/STEM laboratory construction or renovations in science/STEM laboratories:

1. Review National Fire Protection Association (NFPA), International Code Council (ICC) codes and other appropriate standards for educational institutions' science/STEM laboratories. Depending on the science educator's state or town, additional or alternative codes may be applicable and therefore should be researched.
2. Consult with the local and/or state authority having jurisdiction: fire marshal, building inspector or safety officer for applicable laboratory occupancy load codes/standards.
3. Be active in contributing to or directly involved in writing education specifications for facilities in efforts to meet occupancy load design expectations.
4. Help to educate administrators, board of education members, architects and others associated with decision-making power in efforts to better

meet or exceed codes/standards for a safer working environment based on functions being effected.

5. Reduce or eliminate hands-on activities which in the science/STEM teacher's judgement are unsafe in cases where laboratory occupancy loads are surpassed.

B. For existing science/STEM laboratories:

1. Review NFPA and ICC codes for academic institutions science/STEM laboratories. Again, the science/STEM educator's state or town may have additional or alternative codes, which need to be researched and met.
2. Have the "authority of jurisdiction" assist to determine the occupancy load design of your laboratory facility.
3. Work with administrators in efforts to achieve and exceed the code/standard; e.g., changing factors necessary to better meet code/standard, reduction in class size to meet occupancy load.
4. Reduce or eliminate hands-on activities which in the science/STEM teacher's judgement are unsafe in cases where laboratory occupancy loads are surpassed.

C. For science/STEM laboratory instruction involving academic considerations:

Science/STEM lab occupancy loads should also be determined by the type of course, the age and maturity level and special needs of students. It is important to note that for some classes of younger, more active students, no more than 20 students should be assigned (even if there are 24 "built-in" lab stations). When special needs students are assigned to lab science/STEM courses, appropriate professional or paraprofessional assistance should be provided and included as part of the occupancy load factor.

Conclusion:

Overcrowded science/STEM classrooms/laboratories have been clearly shown through research to increase the risk of accidents, given the nature of the potential hazards occupants may be exposed to. Supervisors need to make sure designated occupancy loads are adhered to and not surpassed for the safety of all in the teaching/learning environment.

References:

- Duty or Standard of Care, National Science Teachers Association Safety Advisory Board White Paper: <http://www.nsta.org/docs/DutyOfCare.pdf>
- Overcrowding in the Instructional Space, National Science Teachers Association Safety Advisory Board White Paper: <https://www.nsta.org/docs/OvercrowdingInTheInstructionalSpace.pdf>
- Stroud, L., Roy, K. R., & Doyle, K. S. (2021). Science Laboratory Safety Manual (4th ed.). National Safety Consultants, LLC
- Factors with the Greatest Impact on Safety in Pennsylvania's T&E Courses: [TEEAPJournal-Spring2021-Vol69-No1 \(1\)542021.pdf](https://www.nsta.org/docs/TEEAPJournal-Spring2021-Vol69-No1(1)542021.pdf)

Credits:

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