



Science Education Facilities

Considerations for Safety

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School Planning Section

NCDPI School Planning Section

- N.C. General Statute requires the State School Superintendent to review all public school projects.
- School Planning Section performs this function for the State Superintendent

Science Education Space Recommendations

■ NCDPI

Elementary

Regular Classroom 1,000 - 1,200 sf

Designated Science Clrm. 1,000 sf

Middle School

Science Clrm. 1,000 – 1,200 sf

Math / Science Clrm. 1,000 sf

Science Education Space Recommendations (Cont'd.)

High School

Physical Science	1,200 sf
Biology	1,200 sf
Physics	1,200 sf
Earth Science	1,400 sf
Chemistry	1,500 sf
Multipurpose Science	1,500 sf
Storage / Prep Rms.	250 sf

Science Education Space Recommendations (Cont'd.)

- NSTA (24 students)
- Elementary
- Science Room 960sf (40sf/student)
- Multi-use Clrm. 1,080sf (45sf/student)

Science Education Space Recommendations (Cont'd.)

- Middle / High School
- Pure Laboratory 1,080sf
(45sf/student)
- Comb. Lab/Clrm. 1,440sf
(60sf/student)

[Elementary Science Rooms]

- Regular self-contained classroom?
- Or special “Discovery Room”?

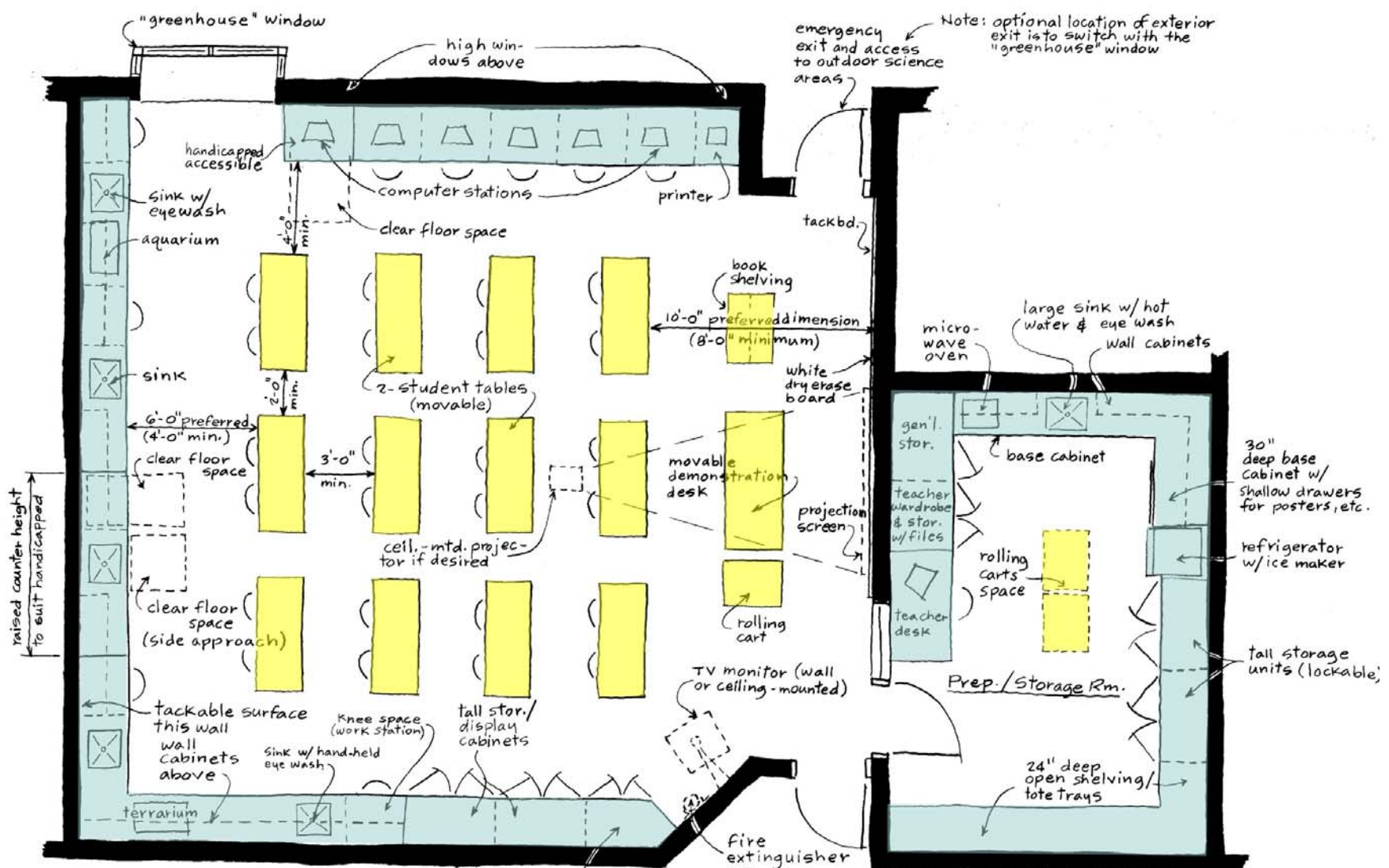
- Separate science rooms for K-2 and 3-5 students.
- Much flexibility
- Flat-topped, movable tables
- 1 sink per 4 to 6 students
 - Stainless steel
 - Hot & cold water

Elementary Science Rooms (Cont'd.)

- Lockable storage for innocuous materials such as glues, paints, etc.
- Plastic laminate covered counter tops
- Vary size & type of storage units
- Tall lockable storage units secured to wall
- Wall cabinets: always located over base cabinets

[Floor plan (elementary)]

- “Dedicated” / “Specialized” Science Classroom (Discovery Room)



"DEDICATED" / "SPECIALIZED"
 ELEMENTARY SCIENCE CLASSROOM
 (DISCOVERY ROOM)

[Floor Plan (elementary)]

- Multiple-use Elementary Clrm. (Where Science Can Be Taught)

[Middle School Science Rooms]

- Convenient to other classrooms of same grade level
- Team teaching:
- 2-Teacher teams:
 - Lang. Arts / Soc. Studies + Math / Science
 - = 50% of Classrooms to be Science
- 4-Teacher teams:
 - LA + SS + Math + Science
 - = 25% of Classrooms to be Science

Middle School Science Rooms (Cont'd.)

- Flexibility is an asset here
- Laboratory / Classroom:
- Flexible arrangement:
 - Movable 2-student tables: Center of room for lectures or two together between sinks along wall for lab.
- Fixed arrangement:
 - Movable tables around fixed islands for lab.
 - Tables or tablet-arm chairs for lecture.

Middle School Science Rooms (Cont'd.)

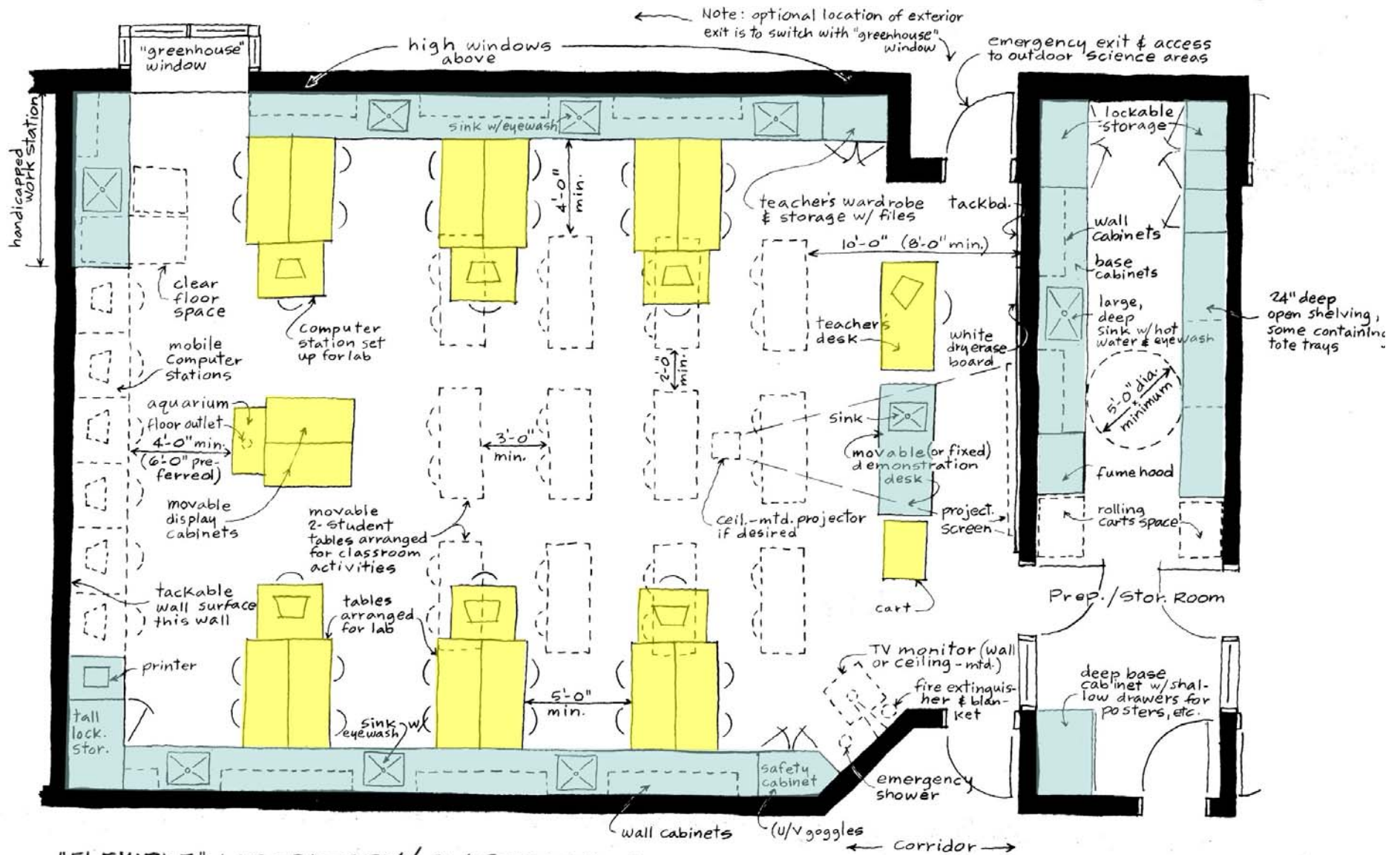
- Sinks:
- One sink per 4 students
- Wide and deep resin sinks w/ swiveling gooseneck faucet equipped w/ an aerator
- Hot and cold water
- Consider one sink w/ sloping tray each side w/ plaster trap
- Deep, enameled-porcelain janitor's slop sink recommended by NSTA

Middle School Science Rooms (Cont'd.)

- Epoxy resin counter tops w/ caulked 4" backsplash
- Movable (2-student) lab tables: 54" x 24" w/ black resin tops
- Movable demonstration table is preferred by most teachers
- Gas only in demonstration table (then, only if required by science program)

[Floor plan (middle school)]

- “Flexible” laboratory / classroom



"FLEXIBLE" LABORATORY/CLASSROOM for MIDDLE SCHOOL SCIENCE

[High School Science Rooms]

- Departmentalized:
 - One fully-equipped science wing
- Smaller “Houses” or “Schools-Within-a-School”:
 - Science rooms in each house / grade level

High School Science Rooms (Cont'd.)

- Compromise Solution:
 - Science rooms in central core of “spoke” arrangement.
 - “Houses” or separate departments in each wing.
 - Can accommodate either organizational model

High School Science Rooms (Cont'd.)

- Laboratory / Classroom Configurations
- - Two clrms. sharing one lab (Not recommended; difficult scheduling)
- - Separate classrooms & labs
- - Combination lab & classroom

High School Science Rooms (Cont'd.)

- Combination Lab & Classroom
Maximum instructional options
Most flexible use of space
- Fixed work stations & separate lecture area....or
- Flexible arrangement with utilities along perimeter & movable tables for lab or lecture

High School Science Rooms (Cont'd.)

- Fixed work stations & separate lecture area
- Freestanding complete work stations located in one portion of the room
 - Four or more students per station
 - Tablet arm chairs in lecture area

High School Science Rooms (Cont'd.)

- Fixed work stations & Separate lecture area (Cont'd.)
- Freestanding utility island w/ movable lab tables

Lab tables can be moved to lecture area

More flexible use of space

High School Science Rooms (Cont'd.)

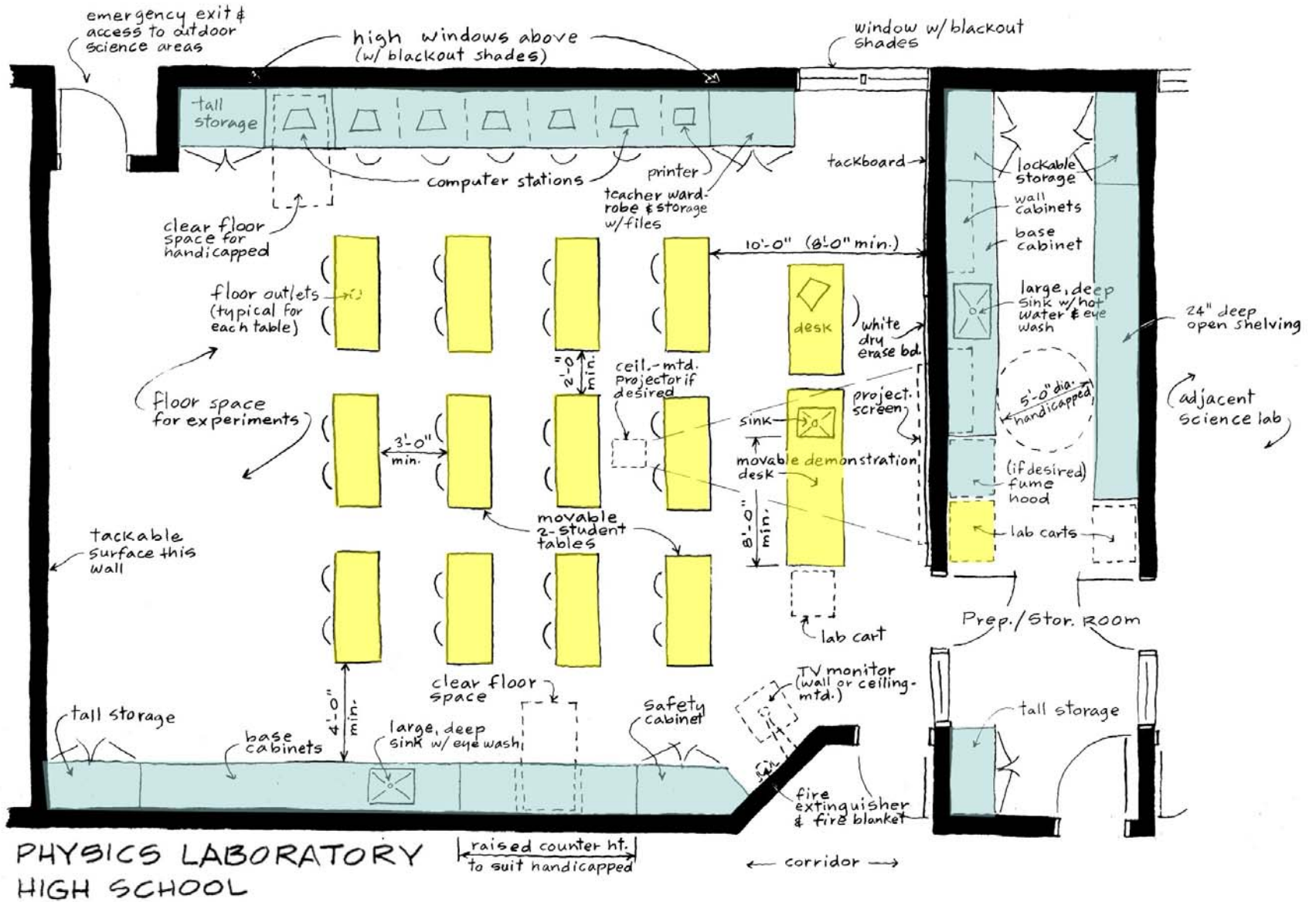
- Flexible room arrangement
- Sinks & utilities along perimeter walls
- Movable flat lab tables, pushed up to perimeter counters for lab or used in lecture area
- Most effective use of space

High School Science Rooms (Cont'd.)

- Generally same type of sinks, work stations & cabinets as Middle School
- Several sinks equipped with dual eyewashes
- May need acid dilution trap (limestone chips) if corrosive chemicals used
 - Option: acid-resistant piping to central dilution tank
- Work stations for chemistry should be at standing height w/ all stools & chairs removed

[Floor plan (high school)]

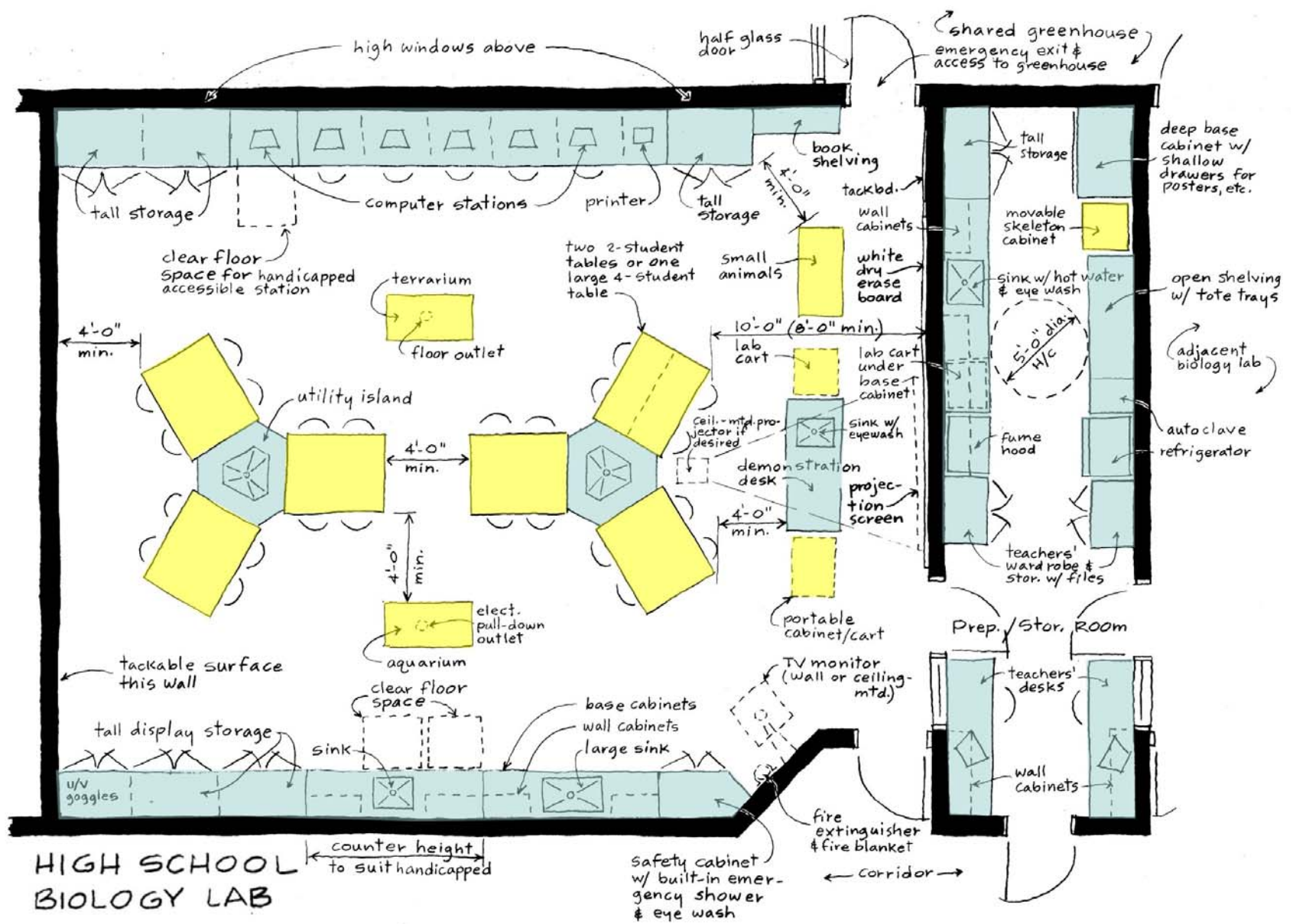
- Physics Laboratory



PHYSICS LABORATORY
HIGH SCHOOL

[Floor plan (high school)]

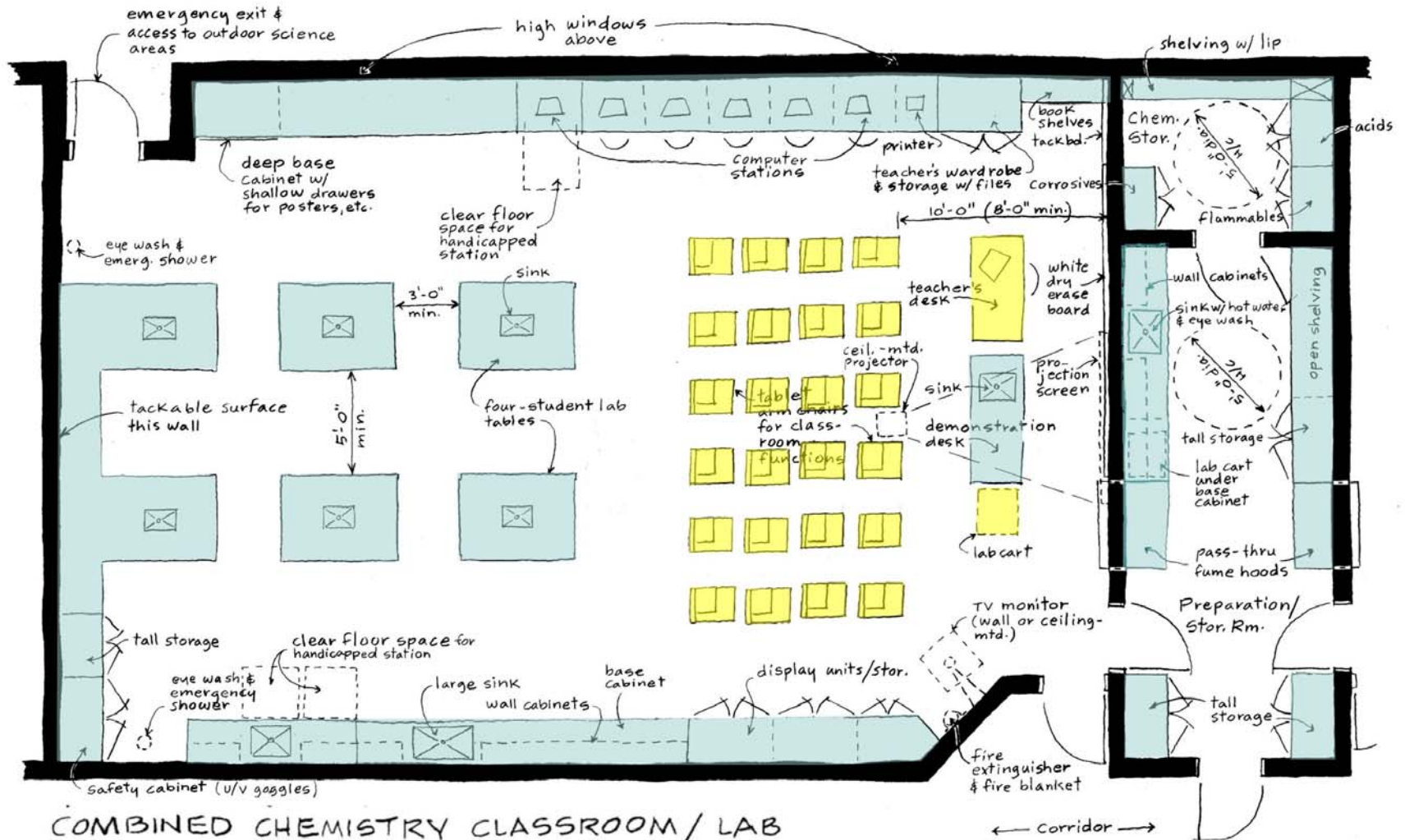
- Biology



HIGH SCHOOL BIOLOGY LAB

[Floor plan (high school)]

- Chemistry



COMBINED CHEMISTRY CLASSROOM / LAB
 HIGH SCHOOL

General Lab Recommendations

- Project and science rooms should have windows (also darkening capabilities)
- Room width: 30 ft. minimum
- 10'-0" minimum ceiling height
- Electrical outlets w/ ground fault interrupter (GFI) protection
- Enough outlets to avoid extension chords
- 2-way communication between classroom & office
- Emergency shut-off controls for water, electric service & gas near teacher's station

General Lab Recommendations (Cont'd.)

- Lighting:

General: 50 ft. candles / sf

Work surface: 75 – 100 ft. candles / sf

Parabolic fluorescent fixtures or indirect lighting is recommended for avoiding glare on computer screens

General Lab Recommendations (Cont'd.)

- Hot water (below scalding temperature)
- Dry-erase marker boards (Avoid chalk boards, as chalk dust can be harmful to computers and students)
- Use marine grade plywood for cabinets subject to moisture (not particleboard)
- Hinged cabinet doors provide more usable cabinet depth than sliding doors
- Provide storage for students' coats / book bags to get them out of the way
- Wall cabinets: Always located over base cabinets
- Use positive cabinet latches that will withstand a seismic event

General Lab

Recommendations (Cont'd.)

- Principles of room layout:
- All students face teacher in lecture area
- Sufficient space to allow students to work safely
- Teacher can move around easily to observe lab activities
- Clear egress pathways at all times

[Preparation / Storage Room]

- National Science Teachers Assoc. recommendation: 10 sf / student
- NCDPI: 250 sf
- For elementary “Dedicated” science rooms a prep room is desirable. For middle & high schools, essential.
- Consider locating the preparation room between two science labs for sharing
- Width: 10 ft minimum
- Locking doors from adjacent labs & corridor
- Teacher knee space, locking file cabinets, computer, telephone, view to lab & not near sink
- Space to park lab carts

Preparation / Storage Room (Cont'd.)

- Spark-free refrigerator w/ ice maker
- Open wall space for large apparatus
- Various types / sizes of storage cabinets:
wall, base, tall, drawers, open
- Sufficient length of epoxy resin counter tops
- Large sink w/ hot & cold water & swivel faucet
- Consider high density track shelving
- Lips on shelves in seismically active areas
- Micro wave oven

Preparation / Storage Room (Cont'd.)

- Fume hood & dishwasher for middle & high schools
- May have a distillation unit and / or autoclave in high schools
- No hazardous chemicals should be stored in the preparation / storage room
- GFI protected circuits
- Well-lighted, including task lights under wall cabinets

Chemical Storage Room

- Separate room opening off preparation room w/ locking, fire-rated door, swinging outward
- NSTA recommends 1 sf / student for chemical storage rooms (part of 10 sf for prep & storage area)
- Provide enough space to allow storage in compatible groups & enough distance between incompatible chemicals.
- Use commercially available, separate chemical storage units for acids, flammables & corrosives

Chemical Storage Room (Cont'd.)

- Shelves & cabinets:
 - Properly secured to wall
 - Corrosive-resistant materials
 - 12" maximum depth (Store only 2 rows of containers)
 - Sufficient amount of shelving so chemicals can be reached easily and not knocked over
 - Provide lips on shelf edges
- Do not store corrosive chemicals above other chemicals
- Provide protected location for water-sensitive chemicals, especially to shield from fire sprinklers

Chemical Storage Room (Cont'd.)

- Gypsum board ceiling (or walls extended to roof deck if acoustical panels are used)
- Material Safety Data Sheets (MSDS): Properties of hazardous chemicals prominently located both inside & outside of chemical storage room

[Safety Equipment]

- Fume hoods: (ASHRAE)
- Containment of hazards in a fume hood is based on the principle that a flow of air entering at the face of the fume hood, passing through the enclosure, & exiting at the exhaust port prevents the escape of air borne contaminants from the hood into the room.
- Air currents external to the fume hood can jeopardize hood's effectiveness:
 - Air supply distribution patterns in lab
 - Movements of the researcher
 - People walking past the fume hood
 - Thermal convection
 - Opening of doors & windows

[Safety Equipment (Cont'd.)]

- Fume hoods (cont'd.)
- Required for high school chemistry, physical science & other labs where hazardous or vaporous chemicals are used
- Advanced chemistry may need two widely spaced fume hoods
- Make-up air required
 - Through building's ventilation system
 - Or part of hood itself when turned on
- Exhausted directly to outdoors sufficiently remote from any air intake (s/s duct to roof preferred)

[Safety Equipment (Cont'd.)]

- Fume hoods (cont'd.)
- 80 linear feet of air flow / minute (minimum) @ fume hood face w/ sash open 6" above bench or counter
- Place mark at sash level to produce 100 lin. ft. / min. flow & date of last measurement
- Fume hoods should be tested annually
- Recommended: Free-standing hood w/ 4 transparent sides (only one operable)
- Not recommended: Individual down-draft fume hoods at each student work station
- Never recommended: ductless hoods
- Hood to be designed for handicapped accessibility

[Safety Equipment (Cont'd.)]

- Eye wash & safety shower
- Required in chemistry and physical science labs (others where hazardous chemicals are used, per OSHA requirements)
- Maximum distance from every work station:
 - eye wash: 25 ft
 - shower: 50 ft
- Shower: floor drain w/ trap & primer
- 1 eye wash & 1 shower: H/C accessible

General Building Safety

- Emergency Exits
- N.C. Building Code:
 - Labs or classrooms of 1000 sf or more require 2 remote exits w/ out- swinging doors
- NSTA:
 - Recommends 2 exits from any lab or prep room
- Emergency Escape Windows
- N. C. Building Code:
 - Every classroom shall have at least one outside window for emergency rescue and ventilation.

General Building Safety (Cont'd.)

- Fire Protection
- 1-hr fire-rated corridors & corridor doors are required in school buildings without an automatic sprinkler system
- Fire alarms, smoke alarms, fire extinguishers, etc. as required by code (Detailed discussion presented by others)

General Building Safety (Cont'd.)

- Ventilation
- Science labs, preparation rooms, chemical storage rooms & other rooms where chemical spills may occur should have constant negative air pressure, relative to the remainder of the school building.
- Additionally, a manually operated exhaust fan in each space is needed to eliminate odors / noxious fumes when needed. Exhausts directly to the exterior, not recirculated in the HVAC system.
- (Detailed discussion presented by others)