Cleveland State Law Review

Volume 16 | Issue 1 Article 9

1967

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MODERN TECHNOLOGY makes use of the dynamic forces of steam, electricity, chemicals, and a most powerful energy—ionizing radiation. These forces multiply human power a thousand-fold when under control but are equally destructive when out of control.[1] New adaptations of known technologies often produce unforeseen hazards in unchartered areas of science. It is readily apparent that the human organism is imperfectly adapted to this new mechanical-chemical-radiological environment.[2]

Knowledge is gained by two fundamental mediums: academic experimentation and industrial research, the former necessarily preceding the latter.

Academic laboratory liability

A steady stream of new materials and new technical study subjects makes science education exciting; but to some, these unknowns make science education a bit frightening.[3] A recent educational bulletin described an incident in which a chemistry student was diligently completing his experiment report at a laboratory table when a fellow student's experiment exploded nearby. Although an innocent bystander, the first student spent weeks in the hospital recovering from an eye injury and narrowly escaped blindness.[4] Some laboratory accidents are far more serious,[5] however, and could often be avoided if schools exerted due care in handling academic laboratory experiments.[6]

Hence, with the steady advancement of scientific research and the increased emphasis on scientific education, it behooves

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1 Somers, Workmen's Compensation 7 (1954).

2 Ibid.

3 Metropolitan Life Insurance, Accident Prevention Can Be Learned 37 (1962).

4 Id. at 7.

5 National Safety Council, Recent Experiences with Isopropyl Ether, Safety Newsletter (May, 1966). An incident was described in which the individual involved was practically disemboweled by an isopropyl ether explosion and died two hours later.

6 Mastrangelo v. Westside Union High School of Merced County, 2 Cal. 2d 540, 42 P. 2d 634 (1935).

educational institutions to educate themselves regarding potential legal repercussions evolving from inevitable laboratory accidents.[7]

Since the *Brigham Young University* case,[8] educational institutions may not rely on charitable immunity to obtain relief from tort liability arising from laboratory injuries.[9] In the *Brigham Young* case a freshman student misused red phosphorus (a highly reactive and potentially dangerous material[10]), causing a violent explosion which seriously injured the student. The court concluded that the student's injury was proximately caused by the laboratory instructor's negligence.[11] The instructor was acting within the scope of his duties, and the general rules of tort liability and agency were applicable. Thus, the school was held to be the legal cause of the injuries sustained.[12] No charitable immunity from tort liability was granted, and the school was held responsible for the ensuing damages.[13]

A. Schools' duty of care

Educational institutions undertaking to provide laboratory courses in their prescribed curricula have a duty to provide an outline of reasonably safe chemical experiments.[14] Due care should be exercised to exclude dangerous experiments where the limited educational benefit derived does not justify the potential risk of serious injury to the student.[15] Laboratories

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[7] Nihan and Webster, Personal Injury Claims Against Schools Are Increasing, 38 Safety Education 10 (February, 1959). Authors reveal that a single judgment was recently granted by an Illinois court amounting to three-quarters of a million dollars ($750,000).

[8] Brigham Young University v. Lillywhite, 118 F. 2d 836 (10th Cir. 1941).

[9] Prosser, Law of Torts 1023 (3rd ed. 1964). The author indicates that most states reject the charitable immunity theory, with few exceptions, particularly where the charity participates in a commercial enterprise. At page 1024, the author explicitly describes the retreat of all charitable immunities, "The immunity of charities is clearly in retreat, and it may be predicted with some confidence that the end of the next two decades will see its virtual disappearance from the American Law." See also, Oleck, Non-Profit Corps., Orgns. & Assns., Secs. 56-58 (2d ed. 1965).

[10] Sax, Dangerous Properties of Industrial Materials 1013 (1957).

[11] Brigham Young Univ. v. Lillywhite, *supra*, n. 8, at p. 842. The court considered that the student may have made a mistake proximately causing the explosion but concluded that the failure to properly supervise proximately caused the mistake.

[12] Restatement, Torts, sec. 431 (court opinion notation).

[13] Brigham Young Univ. v. Lillywhite, *supra*, n. 8, at p. 842. "No exceptions or immunities are granted to charitable institutions or universities not operating for profit, particularly if the tort is against a paying student."

[14] Gregory v. Board of Education of the City of Rochester, 222 App. Div. 284, 225 N. Y. S. 679 (1927).

[15] Mastrangelo v. Westside Union High School, *supra*, n. 6.

must be equipped with necessary safety devices such as proper ventilation and hazardous fume hoods,[16] operable fire fighting equipment,[17] safe fire escapes,[18] and adequate access to first aid facilities must be provided.[19] Laboratory safety rules should be devised, and instructors are expected to enforce them.[20]

Schools have a duty to furnish qualified and responsible instructors educated in the science and having a knowledge of the specific dangers involved in handling chemicals.[21] Instructors must exercise reasonable prudence in ascertaining the dangerous characteristics of experiments and exercise due care to provide proper safety precautions.[22] Laboratory instructors have an active duty to maintain proper supervision commensurate with potential dangers surrounding the prescribed experiments.[23]

Minimum supervision requires the instructor[24] to be present in the laboratory for the duration of the experiments and to maintain close surveillance of experiments known to be troublesome and dangerous.[25]

Instructors must educate students in relation to the students'

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[16] Estelle v. Board of Education, 26 N. J. Super. 9, 97 A. 2d 1 (1953). Sax, op. cit. *supra,* n. 10, see chap. 2, "Ventilation Control." For required miscellaneous safety equipment such as safety goggles, emergency eye-wash fountains, emergency showers, respiratory devices, safety shields, etc., see chap. 3, "Personal Protection and Personal Hygiene."

[17] Jay v. Walla Walla College, 9 Negl. Cases 2d 482 (Wash. Super. Ct. No. 34,683—1959).

[18] Agnew v. State, 166 Misc. 602, 2 N. Y. S. 2d 954 (Ct. of Claims 1938). Lack of a fire escape was the principal cause of a student's injuries sustained when he jumped from a window which was the only means of escape.

[19] Duda v. Gaines, 12 N. J. Super. 326, 79 A. 2d 695 (1951). Seitz, Legal Responsibility Under Tort Law of School Personnel and School Districts as Regards Negligent Conduct Towards Pupils, 15 Hastings L. R. 495, at 505 (May, 1964). "Depending on circumstances this might range from calling a nurse, doctor, or first aid expert in the school building, contacting a physician or a police emergency squad."

[20] Prosser, op. cit. *supra,* n. 8, at p. 546. National Safety Council, Safety in the Chemistry Laboratory, Data Sheet No. 59 (revised 1963).

[21] Damgard v. Oakland High School, 212 Cal. 316, 298 P. 983 (1931); Reagh v. San Francisco Unified School District, 119 Cal. App. 2d 65, 259 P. 2d 43 (1953).

[22] Damgard v. Oakland High School, *supra,* n. 21.

[23] Brigham Young Univ. v. Lillywhite, *supra,* n. 8; Mastrangelo v. Westside Union High School, *supra,* n. 6; Levens, Liability of Chemistry Teachers, National Safety Newsletter (May, 1966). "The chemistry teacher has no higher duties than any other teacher, but the greater hazard potential encountered in the chemistry laboratory requires more diligence in preventing accidents."

[24] *Instructor* should be construed to include authorized qualified assistants.

[25] Brigham Young Univ. v. Lillywhite, *supra,* n. 8; Jay v. Walla Walla College, *supra,* n. 17.

age, experience, and the dangers involved.[26] Pupils receiving instructions in the rudiments of chemistry cannot be expected to know in advance matters in which they are receiving instruction.[27] Hence, laboratory procedure manuals cannot be relied upon to sufficiently instruct students, and specific warnings describing latent dangers of each experiment must be conveyed by the instructor.[28] Advanced students may be relied upon to mix the proper chemicals according to a manual's directions, since it is difficult for instructors to distinguish chemicals once they have been intermixed.[29] A young and inexperienced student, however, would require the strictest supervision in selecting chemicals and compounding the mixture while formulating an explosive substance.[30]

No reliance may be placed in laboratory manual procedural instructions which, if not performed precisely correctly, may result in a violent explosion.[31] In the *Mastrangelo* case,[32] a student was required to compound and ignite an explosive gunpowder material. Instructions for the gunpowder experiment directed the student to select three different chemical powders and to pulverize each powder *separately* with a mortar and pestle. The student inadvertently intermixed the three dry chemicals and then pulverized the powders *concurrently,* contrary to the manual's procedural instructions. An ensuing violent and unexpected explosion occurred, seriously injuring the student. The court held that the error was not unreasonable and that the student's inadvertence was not contributory negligence.[33] The opinion emphasized that it was not an unreasonable duty of the instructor to supervise and instruct students regarding the selection, mingling, and utilization of ingredients with which dangerous explosives are made, rather than merely distributing a textbook containing general instructions.

Although a student may have previously used a dangerous chemical, an instructor's supervision of the student's use is still required.[34] A student may be familiar with the chemical but

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[26] Brigham Young Univ. v. Lillywhite, *supra,* n. 8; Mastrangelo v. Westside Union High School, *supra,* n. 6.

[27] Damgard v. Oakland High School, *supra,* n. 21.

[28] Brigham Young Univ. v. Lillywhite, *supra,* n. 8.

[29] Ibid.

[30] Mastrangelo v. Westside Union High School, *supra,* n. 6, at p. 638. "But at the very least, if the experiment must be performed, it necessarily requires the strictest personal attention and supervision of the instructor."

[31] Ibid.

[32] Id.

[33] Id. at page 638. "We have no sympathy with the defense that the book called for certain ingredients, and that the idea of a student putting in some other ingredient was out of his (plaintiff's) mind."

[34] Reagh v. San Francisco Unified School District, *supra,* n. 21.

unfamiliar with the potential dangers of misuse, and it is the duty of the instructor to exercise that degree of supervision commensurate with the inherent danger of the chemical in use.[35]

Warnings against the use of wrong chemical mixtures must be included in the instructions given while preparing for a specific experiment.[36] Thus, students are not expected to remember general warnings given in previous experiments or general warnings received in previous lecture courses.[37]

Learning institutions are not intended to be insurers of a student's safety; however, they are susceptible to tort liability for negligence, *i.e.,* the failure to exercise reasonable care.[38] Evidence of similar supervision and safety practices utilized in similar learning institutions may be introduced and considered in determining whether due and reasonable care has been exercised in providing sufficient supervision, but a general practice or custom would not excuse the institution's custom unless it was consistent with due care.[39]

Public schools and universities should take caution in being complacent in the security of a governmental immunity defense.[40] Several state legislatures have abrogated the immunity of state schools, and the doctrine of governmental immunity in torts is rapidly becoming an historical anachronism.[41]

A student generally acquires the status of an invitee, and no contractual basis exists to sustain an assumption-of-risk defense.[42] That pupils are not learned in all phases of chemistry is inherent in their status as students.[43] Thus, students generally do not possess the knowledge of specific potential dangers or appreciate the risk assumed.[44]

A student may contribute toward an accident by his own error. However, the error may not be unreasonable conduct and, therefore, not contributory negligence.[45] In these circumstances the proximate cause of the injury may be attributed to

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[35] Ibid.; Mastrangelo v. Westside Union High School, *supra,* n. 6 .

[36] Mastrangelo v. Westside Union High School, *supra,* n. 6; Brigham Young Univ. v. Lillywhite, *supra,* n. 8.

[37] Brigham Young Univ. v. Lillywhite, *supra,* n. 8.

[38] 86 A. L. R. 2d 543; Seitz, op. cit. *supra,* n. 19.

[39] Brigham Young Univ. v. Lillywhite, *supra,* n. 8; Reagh v. San Francisco Unified School District, *supra,* n. 21.

[40] Seitz, op. cit. *supra,* n. 19.

[41] Nihan and Webster, op. cit. *supra,* n. 7; Lawyer, Birth and Death of Governmental Immunity, 15 Clev.-Mar. L. R. (3) 529 (Sept., 1966).

[42] Jay v. Walla Walla College, *supra,* n. 17, at p. 484.

[43] Ibid.; Brigham Young Univ. v. Lillywhite, *supra,* n. 8.

[44] Prosser, op. cit. *supra,* n. 9, at p. 452.

[45] Reagh v. San Francisco Unified School District, *supra,* n. 21; Mastrangelo v. Westside Union High School, *supra,* n. 6.

an instructor's lack of supervision.[46] A contributory negligence defense may be sustained, however, when a student performs unauthorized experiments without permission and without supervision, or when a student's horseplay proximately causes the accident.[47]

B. Schools' miscellaneous liabilities

The potential hazard of chemicals and the subsequent liability therefrom need not be confined to sanctioned experiments required by a science curriculum. Liability may arise from negligently maintained chemical storerooms which enable students to obtain dangerous chemicals without permission or allow hazardous chemicals to be readily accessible for a student's unsupervised use.[48] In some instances an unlocked chemical storage area has been classified as an attractive nuisance.[49]

Bottles of hazardous chemicals should not be maintained in an unsafe manner, such as storing corrosive acid in an uncorked bottle.[50] Mislabelled containers are extremely dangerous, and any questionable unlabelled and old chemicals should be disposed of immediately.[51]

Schools are charged with the duty to use due care in maintaining safe storage of chemicals potentially dangerous in combination.[52] Utmost care is required in dispensing chemicals to insure that the student receives the proper chemicals for the proper experiments.[53] Many chemicals physically appear alike. Due care must be exercised in distributing chemicals with similar physical properties but with disastrously dissimilar chemical properties.[54] Easily mistaken chemicals must not be dispensed at

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[46] Brigham Young Univ. v. Lillywhite, *supra*, n. 8.

[47] Grosso v. Witteman, 266 Wis. 17, 62 N. W. 2d 386 (1954). Wilhelm v. Board of Education, 16 App. Div. 2d 707, 227 N. Y. S. 2d 791 (1962), affd., 12 N. Y. 2d 988, 189 N. E. 2d 503 (1963). This case held that the student had actual knowledge of the dangerous properties of the chemicals that caused the accident.

[48] Frace v. Long Beach City High School District, 58 Cal. App. 2d 60, 137 P. 2d 60 (1943); Reagh v. San Francisco Unified School District, *supra*, n. 21.

[49] Frace v. Long Beach City High School District, *supra*, n. 48.

[50] Grosso v. Witteman, *supra*, n. 47; Sax, op. cit. *supra*, n. 10, see chap. 7, "Storage and Handling of Hazardous Materials."

[51] Hamburger v. Cornell University, 240 N. Y. 328, 148 N. E. 539 (1925). Manufacturing Chemists Association, Case Histories of Accidents in the Chemical Industry 6 (1966). See case No. 603. Also see case No. 1043 at p. 218, where an empty reagent bottle exploded due to a residue of unstable peroxides. Voeglein, Storage and Disposal of Dangerous Chemicals, 43 J. of Chemical Education A151 (Feb., 1966).

[52] *Gregory v. Board of Education of City of Rochester*, *supra*, n. 14.

[53] Mastrangelo v. Westside Union High School, *supra*, n. 6; Gregory v. Board of Education of City of Rochester, *supra*, n. 14.

[54] Mastrangelo v. Westside Union High School, *supra*, n. 6.

the same time and should not be placed in near proximity on a common chemical distribution shelf.[55]

Corresponding with the duty of supervising chemical experiments and proper distribution of chemicals, a similar duty of care requires that laboratories be locked when not in use.[56]

Industrial laboratory liability

Frequently in industrial experimental laboratories, latent dangers are inherently present as potential chemical energy, and violent eruptions may occur, caused by instantaneous chemical reactions. A general philosophy is promulgated that accidents do not just happen; they are caused.[57] However, the ensuing explosion frequently appears to the industrial chemist to "just happen." [58]

In addition to unexpected accidents, side effects from long continued chemical experimentation have been known to result in loss of the senses of sight, taste, and smell.[59]

In contrast to a student, the industrial chemist is confronted with a master-servant status; and to recover for injuries related to research employment, master-servant laws must be considered.

A. Workmen's compensation

Statutory changes have affected the status of the industrial chemist in some states and have classified laboratory research as hazardous employment.[60] Under workmen's compensation laws, the employer is strictly liable for injuries irrespective of the employer's negligence and disregarding common law defenses.[61] Unfortunately for the industrial chemist, inadequacies exist in workmen's compensation laws since many research activities are not included within statutory coverage.[62]

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[55] Mastrangelo v. Westside Union High School, *supra*, n. 6; Brigham Young Univ. v. Lillywhite, *supra*, n. 8.

[56] National Safety Council, Safety in the Chemical Laboratory, Data Sheet No. 59 (revised 1963).

[57] Simmonds and Grimaldi, Safety Management 11 (1963).

[58] Manufacturing Chemists Association (M. C. A.), Case Histories of Accidents in the Chemical Industry, Vol. 1 (1962) and Vol. 2 (1966). A total of 1097 case histories are reported which describe accidents occurring in the chemical industry.

[59] Hendrickson v. Continental Fiber Co., 33 Del. 304, 136 A. 375 (1926); Plaugher v. American Viscose Corp., 151 Pa. Super. 401, 30 A. 2d 376 (1943).

[60] N. Y. Workmen's Comp. L., One, Sec. 3, Gr. 14, in Vol. 11A, Consol. Laws Serv. (N. Y.) (Lawyers Coop.). Annotations cite many cases such as chemical poisoning, etc. See also, Industrial Commission of Ohio v. Burchard, 112 Ohio St. 372, 147 N. E. 81 (1924).

[61] Simpson, Law for Engineers 375 (4th ed. 1958).

[62] Beeman v. Board of Education of Penn Yan, 195 A. D. 357, 87 N. Y. S. 213, affd. 213 N. Y. 624, 132 N. E. 914 (1921). A chemistry teacher was found to be not engaged in a hazardous occupation. Thompson v. Amoskeag Manufacturing Co., 86 N. H. 436, 170 A. 769 (1934).

Excluding radiation research, few states classify industrial research *per se* as a hazardous occupation.[63] Assuming a chemist may otherwise be covered, he could not receive benefits in about twenty states if he should become disfigured but not disabled.[64] As many as eighteen states exclude occupational diseases from statutory coverage unless the disease is specifically designated in the respective state's workmen's compensation statute.[65]

Thus in many situations, if the industrial chemist is to have any legal remedy, he must seek reparation under tort law.[66]

B. Common law

The employer has a duty to exercise ordinary care to provide a reasonably safe laboratory for the industrial chemist to conduct his experimental work.[67] This duty includes the obligation to protect the industrial chemist against dangers which might be anticipated or discovered by proper vigilance, as well as those known to the employer.[68] If an unsafe condition was, in fact, known to the employer and allowed to continue to exist, the employer may be guilty of negligence as a matter of law.[69]

Frequently in chemical laboratories, harmful concentrations of poisonous gases and fumes are spontaneously released from experimental chemical reactions.[70] Constantly being susceptible to this threat of an unexpected evolution of noxious gases, the employer has a duty to provide proper ventilation and install fume hoods.[71]

Unexpected eruptions and chemical explosions occur in experimental processes, often subjecting research personnel to

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[63] U. S. Dept. of Labor, State Workmen's Compensation Laws, Bulletin No. 161 at p. 19 (Sept., 1964); 2 Schneider, Workmen's Compensation 489 (perm. ed. 1942).

[64] Whittlesey (attorney), Will It Be a Lawsuit or Grievance?, Chemical Engineering 124 (Feb., 1966).

[65] Simmonds and Grimaldi, op. cit. *supra,* n. 57. Martin v. Tubize-Chatillon Corp., 66 Ga. App. 481, 17 S. E. 2d 915 (1941); Thompson v. Amoskeag Manufacturing Co., *supra,* n. 62.

[66] Oleck, Cases on Damages 21 (1962), points out that recovery in tort is not limited to economic loss, quoting Franklin et al., Accidents, Money, and the Law, 61 Col. L. R. 1 (1961).

[67] Simpson, op. cit. *supra,* n. 61.

[68] Martin v. Tubize-Chatillon Corp., *supra,* n. 65; Prosser, op. cit. *supra,* n. 9, at p. 546.

[69] McBeth-Evans Glass Co. v. Brunson, 70 Ind. App. 513, 122 N. E. 439 (1919).

[70] Elkins, The Chemistry of Industrial Toxicology 13 (1954).

[71] Cason v. American Brake Shoe and Foundry Company, 32 F. Supp. 680 (D. C. D. Colo. 1940); Dailey v. Mutual Chemical Company of Amer., 125 N. J. L. 465, 16 A. 2d 557 (1940), affd. 126 N. J. L. 426, 19 A. 2d 778 (1941): oxalic acid fumes. Pellerin v. Washington Veneer Co., 163 Wash. 555, 2 P. 2d 658 (1931): carbon bisulfide poisoning. Gentry v. Swann Chemical Co., 234 Ala. 313, 174 S. 530 (1937): tri-sodium phosphate fumes.

bodily contact with corrosive chemicals, and some have, on occasion, resulted in death.[72] Employers are expected to install safety showers and emergency eye-wash fountains which may circumvent serious chemical burns and limit the employee's injuries to minor burns.[73]

The employer is charged with a duty to provide safe equipment and instruments and must exercise reasonable care to maintain them in a safe operable condition.[74] Various research instruments must be so equipped as to protect the operator from latent dangers such as exposure to ultraviolet light.[75] In highly experimental operations when hazards cannot be accurately predicted,[76] the employer is expected to "over-protect" the chemist.[77] Failure to provide adequate safety equipment such as a respiratory mask or safety goggles will result in an employer's liability.[78] Liability may arise for failure to provide explosion-proof electrical equipment, a recurring hazard often overlooked in pilot scale experimental processes.[79]

The employer has a duty to warn of known latent dangers and dangers existing which are chargeable to the employer's knowledge.[80] This duty to warn is particularly applicable to young and inexperienced employees.[81] Hence, a technician may rely on his superior's assurance that no danger exists, and the employer is liable if, in fact, an unsafe working condition does exist.[82] An employer's failure to warn of an unhealthy atmos-

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[72] M. C. A., op. cit. *supra,* n. 51, at p. 39. See case No. 664.

[73] M. C. A., op. cit. *supra,* n. 51. See case No. 605 at p. 9, case No. 639 at p. 27, and case No. 1048 at p. 221.

[74] Prosser, op cit. *supra,* n. 9, at p. 547. M. C. A., op. cit. *supra,* n. 51, at p. 46. Case No. 681 requires the laboratory supervisor to be responsible for maintaining laboratory equipment in good working condition.

[75] Hayes v. Joseph E. Seagram and Co., 222 Ind. 130, 52 N. E. 2d 356 (1944).

[76] M. C. A., op. cit. *supra,* n. 51, at p. 194. See Case No. 988. No literature sources had previously revealed any warnings. The accident fatally injured an engineering technician.

[77] You Must Overprotect in the Pilot Plant, Occupational Hazards 28 (July, 1964). Sax, op. cit. *supra,* n. 10, at chap. 3.

[78] Middlebrook v. Atlanta Metallic Casket, 63 Ga. App. 620, 11 S. E. 2d 682 (1940): respiratory mask. Zajkowski v. American Steel and Wire Co., 258 F. 9 (6th Cir. 1919): goggles. M. C. A., op. cit. *supra,* n. 51, at p. 223 regarding respirators and case No. 1059 at p. 225 regarding shields.

[79] M. C. A., op. cit. *supra,* n. 51. See the following cases where explosions occurred caused by faulty electrical equipment igniting volatile vapors: case No. 782 at p. 96, No. 822 at 116, No. 1013 at 205, No. 1025 at 209, No. 1034 at 214, and No. 1072 at 231.

[80] Middlebrook v. Atlanta Metallic Casket, *supra,* n. 78. Simpson, op. cit. *supra,* n. 61. But see, Oleck, Negligence Forms of Pleading, Sec. 53 (1957 revision) as to third-party liability.

[81] Prosser, op. cit. *supra,* n. 9, at p. 548. M. C. A., op. cit. *supra,* n. 51, at p. 188. See case No. 910 at p. 163 and case No. 1031 at p. 212.

[82] Louisville & N. R. Co. v. Gillidand, 220 Ky. 431, 295 S. W. 422 (1927); Middlebrook v. Atlanta Metallic Casket, *supra,* n. 78.

phere generally would result in a finding of employer negligence.[83]

An industrial chemist versed in the science of chemistry impliedly possesses a reasonable degree of knowledge which is ordinarily possessed by others of that profession.[84] He assumes the risk of all obvious defects and any dangers which he himself may be equally competent to protect himself against.[85] However, a chemist is not expected to assume the risk of perils arising from his employer's negligence.[86] To assume a risk, a chemist must know, comprehend, and appreciate the danger faced, and voluntarily consent to be subjected to the potential danger.[87] A chemist will not assume the risk if he fails to comprehend the danger due to lack of information or experience,[88] but a failure to exercise ordinary care to discover a potential danger may be contributory negligence.[89]

An employer is required to take reasonable precautions to provide suitable and competent co-workers, and this necessarily includes the duty to appoint responsible laboratory supervisors.[90] Reasonable care is expected in promulgating and enforcing laboratory safety rules commensurate with the potential hazards surrounding the research work engaged in.[91]

C. Strict liability

Because of the needs of modern industrialized society, liability without fault will eventually play a significant role in compensating injuries incurred within the scope of research employment.[92] Though denied formal recognition, the capacity to bear the loss is a most important and influential factor which may lead to the imposition of strict liability.[93]

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[83] Middlebrook v. Atlanta Metallic Casket, *supra,* n. 78: lead poisoning. Martin v. Turbize-Chatillon Corp., *supra,* n. 65: surfuric acid poisoning.

[84] Roady, Professional Negligence 309 (1960).

[85] Prosser, op. cit. *supra,* n. 9, at p. 574. The risk assumed is generally in proportion to his knowledge.

[86] Martin v. Eagle-Picher Lead Co., 21 F. Supp. 142 (W. D. Mo. 1937).

[87] Martin v. Tubize-Chatillon Corp., *supra,* n. 65; Middlebrook v. Atlanta Metallic Casket, *supra,* n. 78.

[88] Prosser, op. cit. *supra,* n. 9, at p. 462.

[89] Ibid.

[90] Simpson, op. cit. *supra,* n. 61. M. C. A., op. cit. *supra,* n. 51, at p. 46. See case No. 681. Laboratory supervisor to be responsible for eliminating laboratory hazards.

[91] M. C. A., op. cit. *supra,* n. 51, at p. 46. Prosser, op. cit. *supra,* n. 9, at 549.

[92] Foster and Keeton, Liability Without Fault in Oklahoma, 3 Okla. L. R. 172, at 215 (1950). "Negligence will continue to be the basis of the bulk of tort litigation, but it may be predicted that strict liability will become of increasing importance as the law of the 20th century is adjusted to the needs of modern industrialized society."

[93] Id. at p. 206.

Compensation insurance was originally designed to assist an injured employee to overcome the economic hardships of lost wages, medical bills, and other expenses encountered.[94] It is a formidable task to overcome the common law defenses of contributory negligence, fellow servant rule, and assumption of risk. In fact, the intent of passing workmen's compensation laws was to eliminate these barriers to employee compensation.[95]

If a serious accident occurs, the controlling owners must accept responsibility, disregarding how many others may have intervened and been at fault.[96] Management in ultimate control of the research laboratory should regard providing safe working conditions and safe working practices as fundamental to playing their part in a fair and cooperative relationship with society.[97] The principle is now established that the cost of doing business includes providing medical care and compensation for employees injured in the course of that business.[98]

Conclusions

Liability for injuries sustained by students is increasing, and educational institutions can no longer take refuge in the defenses of charitable immunity and governmental immunity. Due care must be exercised by educational institutions to provide reasonably safe chemical experiments, and proper precautions must be taken to protect students from injuries. Schools and universities are obligated to provide competent instructors who are required to properly instruct students and actively supervise student experiments.

Educational institutions are not expected to be insurers of a student's safety; however, schools must exercise that degree of care required to avoid a negligent disregard of the potential dangers inherent in academic chemical experimentation.

Industry must likewise exert due care to avoid unnecessary exposure of the industrial chemist to unreasonable dangers. Injuries sustained in the industrial research laboratory may be recoverable under workmen's compensation statutes or under tort law. The industrial chemist assumes a limited risk, but he does not assume the perils of his employer's negligence.

The common law should acquire a facet of contemporary strict liability which would recognize industry's duty to society to compensate for injuries sustained in pursuit of the employer's business.

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[94] Simmonds and Grimaldi, op. cit. *supra,* n. 57, at p. 418. Foster and Keeton, op. cit. *supra,* n. 92.

[95] Whittlesey, op. cit. *supra,* n. 64.

[96] Simmonds and Grimaldi, op. cit. *supra,* n. 57, at p. 44.

[97] Ibid.

[98] Id. at p. 19.