

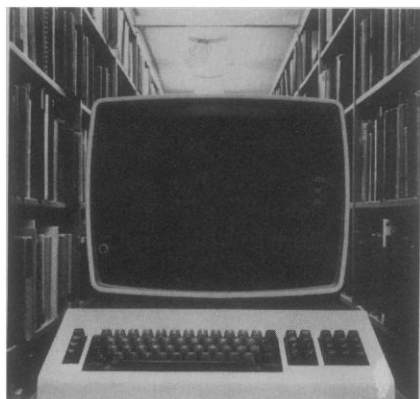
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LETTERS

Love Canal and Legal Precedent

As Barbara Culliton indicates in the article "Continuing confusion over Love Canal" (News and Comment, 29 Aug., p. 1002), the interactions between law and science are frequently complex and difficult. Nowhere is this more true than when courts must deal with problems of toxicology or epidemiology, where, as Culliton notes, different standards are used in law and science. I believe, however, that Culliton and *Science* readers may have been misled by some of the quoted comments made by Anthony Roisman of the Department of Justice.

The statutes that deal with the problems of chemical threats to human health frequently do have an "endangerment" standard which requires less than certainty that harm will result (1). It was just such a standard that was used in the Arkansas case referred to by Roisman (2). It is difficult to see, however, how that case can provide a precedent for the Love Canal problem. The Arkansas case involved the current and future storage and disposal of materials contaminated by 2,3,7,8-tetrachlorodibenzo-*p*-dioxin (dioxin) on land currently owned by the Vertac Chemical Corporation and previously owned by Hercules, Inc. The court applied an "endangerment" standard and required Vertac, the current owner, to take various steps to prevent the escape of dioxin; however, the court expressly refused to require Hercules, the former owner, to do anything (3). In the Love Canal situation Hooker Chemical Corporation, the former owner, may well argue that the Arkansas decision regarding Hercules is a precedent in its favor, not against it, as apparently contended by Roisman.

Furthermore, there is a very important difference between the type of legal action in the Arkansas case and that in the Love Canal case. The Arkansas case was an action in equity seeking an injunction ordering the defendants to do or not do specific things; Love Canal is a tort/nuisance suit seeking monetary payments to compensate the plaintiffs for injuries resulting from past actions of the defendants. Equity actions traditionally have less rigorous standards of causal proof than do tort suits. Tort suits require a showing that "but for" the defendant's action the injury would not have occurred (4).

Courts have a great deal of difficulty accepting statistical evidence as proving "but for" causation. Even the best possible scientific study (cytological, epide-

miological, or other) could merely conclude that "with a 95 percent (or 99 percent, or any other level) degree of confidence, this chemical pollution resulted in these (cellular, physiological, health) effects." Many legal writers think such a statement might not be sufficient to persuade a court that "but for" causation had been demonstrated (5).

In the Love Canal case, then, contrary to the opinion expressed in Culliton's article, attorneys may require much more proof, not much less proof, than the scientific community would; so much more, in fact, that it might be impossible for scientific studies to meet the needs of the legal system. It may be that a legislative change in the required proof of causation, as is included in some of the "superfund" bills pending in Congress, will be necessary to resolve this issue.

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References and Notes

1. For example, Clean Air Act, 42 U.S. Code 7401 (1977); Water Pollution Control Act, 33 U.S. Code 1251 (1977); Safe Drinking Water Act, 42 U.S. Code 300f (1974); Resource Conservation and Recovery Act, 42 U.S. Code 6901 (1976); Toxic Substances Control Act, 15 U.S. Code 2601 (1976); Federal Insecticide, Fungicide and Rodenticide Act, 7 U.S. Code 136 (1972); Occupational Safety and Health Act, 29 U.S. Code 651 (1970). The "endangerment" standard has been applied by the courts in the leading cases of *Industrial Union Dept. v. AFL-CIO v. Hodgson*, 499 Fed. Rep., 2nd Ser. 467 (D.C. Cir. Ct., 1974); *Reserve Mining Co. v. Environmental Protection Agency*, 514 Fed. Rep., 2nd Ser. 492 (8th Cir. Ct., 1975); and *Ethyl Corp. v. Environmental Protection Agency*, 541 Fed. Rep., 2nd Ser. 1 (D.C. Cir. Ct., 1976).
2. *United States v. Vertac Chemical Corp.*, 489 Fed. Rep. Suppl. 870 (E. Dist. Ark., 1980).
3. Admittedly, Hercules did agree to contribute something to the cost of the preventive measures, but the court refused to order it (2, p. 888).
4. See, for example, W. L. Prosser, *Handbook of the Law of Torts* (West, St. Paul, Minn., ed. 4, 1971), pp. 236-290.
5. See, for example, W. Pfennigstorf, *Am. Bar Found. Res. J.* 1979, 347 (1979); J. Borgo, *J. Legal Stud.* 8, 419 (1979).

Geological Research

In 1979 the U.S. Geological Survey celebrated its centennial. During a century it established a reputation as the world's leading geological research institution. Sadly, its future does not look as bright as its past. Present leadership has diverted the Survey from basic geological research and has halted many of its important programs. Its problems are not fiscal, as is often claimed to be the plight of federal institutions, but appear to result from poor leadership and misdirection.

The Survey has both taken on an increasing number of regulatory and con-

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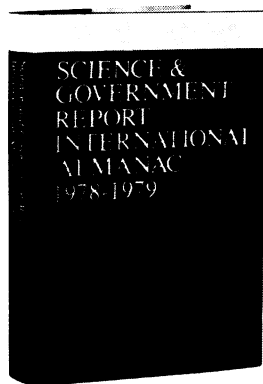
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tract monitoring tasks and decreased its research. Effort to maintain the geological data base has been drastically reduced. Much of the success of the Survey in meeting the demands for earthquake prediction, energy and mineral resources estimation, reactor hazards evaluation, and a myriad of other applied problems has hinged upon a vast accumulation of geological information. No amount of computer manipulation of a static data base can substitute for vigorous, ongoing research and mapping to increase that base systematically.

One searches in vain in the 1979 Survey yearbook for a discussion of geological mapping or research. Publication policy has been changed drastically. High-quality maps and archival book publications are now practically nonexistent; most results of Survey work are released in open-file reports of uneven quality, available only at relatively high cost. Hard money for basic geological mapping and geochemical, geophysical, and paleontological projects no longer exists in the Survey budget. All such work must now be justified under a mission-oriented, line-item program within a politically tangled system of budget management.

If organized concern is not soon expressed regarding the plight of research in the Survey, I fear that it may go down the drain as a driving force in American science. The scientific community should be alerted to these developments.

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Digital Readouts on Television Pictures

Video systems are increasingly being used for data compilation and analysis in behavioral studies (1). The hardware is relatively inexpensive and portable, and videotapes, unlike conventional motion-picture film, are analyzable by instant playback and are reusable. We have developed a simple display module that allows numerical data to be superimposed on television pictures and recorded as part of the televised information. The device, described in technical detail elsewhere (2), is inexpensive, versatile, and electronically compatible with most closed-circuit television systems. It employs standard, large-scale integrated circuits, commonly used in commercial television receivers to display time and channel number. We have found the device particularly useful in time-motion



Fig. 1. Photograph of a television monitor screen displaying a single frame of a videotape with superimposed digital readouts. The upper readout gives the experiment number, and the lower readout (which also serves as frame marker) gives the time elapsed in minutes, seconds, and sixtieths of a second. The videotape is that of a bioassay with ants given untreated food (upper right and lower left sites) and food treated with a chemical repellent (upper left and lower right). Data for the assay are obtained by counting the ants at the treated and untreated sites every 5 seconds over a period of a minute. The readouts make it easily possible to stop the tape during playback at the desired 5-second intervals to make the counts.

analysis of behavioral events, for which purpose the display module is used to indicate the experiment number and time (Fig. 1). The time readout, given in minutes, seconds, and sixtieths of a second, changes with each video frame and can thus serve as a frame and time marker in playback analysis. Since the module can provide a readout of virtually any numerical variable, it is broadly applicable. The cost of the hardware is approximately \$50.

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2. D. Aneshansley, *Behav. Res. Methods Instrum.*, in press.

Erratum: In the report "The testicular feminized rat: A naturally occurring model of androgen independent brain masculinization" by B. H. Shapiro *et al.* (18 July, p. 418), two relevant references were omitted. These are K. L. Olsen, *Horm. Behav.* **13**, 66 (1979) and K. L. Olsen, *Nature (London)* **279**, 238 (1979).

Erratum: The title of the letter from Andrew T. Weil (12 Sept., p. 1182) should have been "Coca, not cocaine." The second and third sentences of the second paragraph should have read, "I have advocated research on the therapeutic properties of whole coca leaf. Cocaine and coca are quite different substances with very different potentials for abuse and benefit."