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COMMENTS

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THE EVIDENTIARY VALUE OF SPECTROGRAPHIC VOICE IDENTIFICATION

Ever since it was heralded in 1962 as a foolproof method of personal identification, voice identification by spectrographic analysis, the "voiceprint" technique, has been in a legal limbo. Scientists could not agree whether the technique possessed any validity at all, or agree on who was competent to pass judgment on that threshold question. Because a judicial determination of the admissibility of scientific evidence and the expert testimony necessary to interpret it is traditionally keyed to scientific acceptance of the principle from which the testimony is derived, the admissibility was withheld. Recent developments in both science and the law, however, indicate that despite initially adverse scientific and judicial reaction, spectrographic voice identification is perhaps coming of legal age. This comment will assess the impact of these developments on the technique’s status as admissible evidence.

The Technique

Speaker recognition by spectrographic voice analysis is a seemingly simple, but fundamentally complex, method of personal identification. In making an identification by this method, the constitutional ramifications of the technique are excluded from the scope of this comment. They are, however, quite real and as yet undefined. The Seventh Circuit, for example, has held that a grand jury may not subpoena a number of witnesses, solely for the purpose of obtaining voice exemplars (apparently for spectrographic comparison), without complying with fourth amendment “reasonableness” requirements. In re Dionisio, 442 F.2d 276 (7th Cir. 1971), cert. granted, 92 S.Ct. 2056 (1972). Serious questions of “reasonableness” also arise in the method used to obtain the voice exemplar. See, e.g., People v. King, 266 Cal. App. 2d 437, 72 Cal. Rptr. 478 (1968); State ex rel. Trimble v. Hedman, _ Minn., _ N.W.2d 432 (1971).

Currently, there are several methods of personal identification which purport to have forensic value. Fingerprints, sole prints, and palm prints are, of course, the most widely recognized. See Inbau, Scientific Evidence in Criminal Cases, 25 J. Crim. L. & C. 500 (1934). Two rather novel methods of personal identification have been suggested recently: Hirschi, Identification of Earprints, 24 Kriminalistik 75 (1970); Suzuki and Tsuchihashi, Personal Identification by Means of Lip Prints, 17 J. For. Med. 52 (1970). It was suggested at one time that electrocardiograms could provide a reliable means of identification, though the author recognized its limited forensic use. Castellanos, Personal Identification by Electrocardiography, 23 J. Crim. L. & C. 356 (1932).

There are three known methods of speaker recognition. The oldest method, of course, is identification by ear. Another method is computer analysis of speech spectrograms. The latter technique is identical to the subjective comparative analysis of speech spectrograms under consideration here, except that a computer is substituted for the human examiner. At present, this method, although potentially more reliable because


2 Although a number of proponents of this method of voice identification refer to it by the popular handle “voiceprint,” that term conjures up an analogy to fingerprint identification which is wholly inapposite. Letter from Dr. Peter N. Ladevogel to Dr. Edward David, Jr., Science Adviser to the President of the United States, May 24, 1971; Bolt, et al., Speaker Identification by Speech Spectrograms: A Scientists’ View of Its Reliability for Legal Purposes, 47 J. Acoustical Soc’y Am. 597, 599–600, 606–08 (1970) [hereinafter cited as Kersta, Nature].

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4 The admissibility of expert opinion testimony derived from novel or scientific procedures and devices is dealt with infra, text accompanying notes 50–69.
first step is to tape-record an exemplar of an individual's voice. The sound spectrum of this speech sample is then scanned electronically by a high-speed sound spectrograph which produces a spectrogram, a visible amplitude-frequency-time display of its inherent objectivity, is unsuitable for forensic application because of the difficulty in quantifying and qualitatively expressing the identity characteristics of speech. See M. Hecker, Speaker Recognition: An Interpretive Survey of the Literature 2, 3, 74–97 (Am. Speech & Hear. Assn. Monograph No. 16, 1971) (hereinafter cited as Hecker, Speaker Recognition).

The sound spectrograph electronically sorts out the frequency components in the sound spectrum of speech and mechanically produces a visual representation of those spectral characteristics as they change over time. For a technical discussion of the operating characteristics of the sound spectrograph see Hecker, Speaker Recognition at 50–56; Premo, High-Speed Sound Spectrograph, 40 J. Acoustical Soc'y Am. 628 (1966); See generally Koenig, Dunn & Lynch, The Sound Spectrograph, 18 J. Acoustical Soc'y Am. 19 (1946); Steinberg & French, The Portrayal of Visible Speech, 18 J. Acoustical Soc'y Am. 4 (1946).

The spectrogram is popularly referred to as a voiceprint. See Figure 1. Frequency is measured along the vertical axis, generally using a logarithmic scale to portray in greater detail the frequency ranges where speaker-dependent identity traits are thought to be manifested. Hecker, Speaker Recognition at 40, 50–56, 62. Time is depicted along the horizontal axis. The “bar” type of spectrogram, which depicts the frequencies produced by energy vibrations in the vocal tract as vertical striations and those of phonetic formants as curved horizontal bars, displays amplitude in the darkness of the resonance bars. The “contour” spectrogram, not generally used in spectrographic voice identification, resembles a contour topographical map, each contour line depicting a specific gradation in the amplitude of the speech signal. Id. at 53–54.

The vocal mechanism consists of the pharyngeal cavity, vocal folds, nasal cavity, tongue mass, soft palate, and oral (mouth) cavity. Hecker, Speaker Recognition at 7. Organic differences in the structure of the vocal mechanism may be due to heredity, sex, and age. Id. at 4.

The placement of the articulators, the tongue, lips, teeth, jaw muscles and soft palate, is an ability learned through imitation. Speech production is thus related to geographic, social, and cultural factors. Id.; Bolt, Reliability at 588–99.
KERSTA: THEORY, EXPERIMENTS AND REPLICATION

Lawrence Kersta, an electrical engineer and physicist, has been the foremost advocate of the validity of personal identification by spectrographic voice analysis. His claim that the technique is accurate and reliable is founded on two propositions.

The theory of invariant speech is the cornerstone of his hypothesis that individuals can be identified by the spectral characteristics of their voices. The theory posits that the characteristic spectral patterns of phonetically identical utterances vary more between two individuals (interspeaker variability) than between two such utterances spoken by the same individual (intraspeaker variability). Although so far the theory has not been proven directly, Kersta has buttressed the theory by applying his own hybrid form of statistical probability to the acoustic theory of speech production. He argues that since both the dimensions of the vocal cavities and the coupling of the articulators, which define the spectrum for a given sound, are affected by heredity, sex, age, and socio-environmental factors, it is extremely unlikely that two individuals would develop spectrographically identical speech patterns. While a superficially attractive rationale for voice uniqueness, a proper application of probability theory demands substantially more precision than this.

Kersta also asserts that a trained examiner, by visually comparing a series of spectrograms for objective points of similarity, can, because of the speech pattern uniqueness reflected on the spectrogram, identify or eliminate one unknown speaker from a group of many known speakers.

Kersta's initial experiments with spectrographic voice analysis demonstrated that the technique showed potential as a means of personal identification, but did not present an identification task. His experiments merely tested the ability of a trained examining team to match spectrograms with speakers in a closed set of exemplars. Using speaker groups of up to twelve members, error

The number of variables which enter into speech production are not easily defined, either in quantitative or qualitative terms. See Hecker, Speaker Recognition at 4-23, 70. In any event, the use of probability theory in court to prove an assumption or conclusion has been criticized by both courts and commentators. See, e.g., People v. Collins, 68 Cal. 2d 319, 438 P.2d 33 (1968); State v. Sneed, 76 N.M. 349, 414 P.2d 553 (1966); Kingston, Probability and Legal Proofs, 157 J. Crim. L.C. & P.S. 95 (1966); Tribe, Trial by Mathematics: Precision and Ritual in the Legal Process, 84 Harv. L. Rev. 1329 (1971). Cf. Coolidge v. New Hampshire, 403 U.S. 443, 448 n.2 (1971).

It is important to note that while the identification process relies for its foundation on scientific principles, the technique itself is not a science but an art. See notes 85-89 and accompanying text infra; cf. People v. King, 266 Cal. App. 2d 437, 451, 72 Cal. Rptr. 478, 487 (1968).

In a matching task the examiner is required only to sort out the spectrograms which most resemble each other, knowing that a match exists. The identification-discrimination task relevant to a practical application of spectrographic voice analysis involves a two step procedure. The examiner must initially decide which, if any, of the spectrograms before him is most similar to that of the unknown voice. He then must decide positively that the two represent a single individual's identical sounds. See generally Hecker, Speaker Recognition 66-68.

In Kersta's sorting trials, four exemplars of ten cue-words for each speaker, spoken in isolation and in context, were recorded and spectrographed. Two-member examining teams were then randomly presented with four same-word spectrograms for each speaker, and asked to sort them into speaker piles. Speaker groups of five, nine, and twelve members were used, but the examiners were aware at all times that an equal number of spectrograms were available for matching with each speaker. The cue words used were the ten words occurring most frequently in American speech: I, you, it, me, on, the, is, and, a, and to. See Kersta, Nature. Kersta apparently used spectrograms of words spoken in isolation as a control, since the spectral characteristics of a given speech sound are defined in part by the sounds which immediately pre-
rates in these trials ranged from 0.8% for words spoken in isolation to 1.0% for words excerpted from context. In subsequent experiments performed under Kersta's direction, the number of speakers represented by the set of spectrograms presented to the examiners was increased, but the matching format of the experiment was adhered to. These experiments confirmed his initial findings.

From these extremely low error rates, Kersta concluded that spectrograms of an individual's speech patterns for particular words are as unique in their identifying characteristics as fingerprints, thus rendering the technique a reliable method of personal identification when performed by a trained examiner. In addition, Kersta claimed that neither passage of time nor conscious efforts at mimicry could frustrate a system of identification based on spectrographic voice analysis. He further maintained that the relatively higher pitch of the female voice would not affect the accuracy of such an identification technique.

Other experimenters, all reputable scientists in speech, phonetics, or associated fields, were unable to duplicate Kersta's high accuracy rates, even for matching-to-sample tests. It appears that most of the difficulty other experimenters experienced can be traced to Kersta's failure to publish detailed technical reports of his experiments and the objective identification factors used by his examiners. Kersta's secrecy, coupled with his defensive attitude toward the technique and the extrapolations he drew from his limited experiments, created an atmosphere of distrust for the entire technique which may have obscured the real issues involved in gaining scientific acceptance for the technique. However, a study completed in 1970 under the direction of Oscar Tosi at Michigan State University not only replicated Kersta's original experiments and confirmed his high accuracy rates for matching-to-sample tests but also tested the accuracy and reliability of spectrographic voice identification in experiments having a true identification format.

THE TOSI STUDY: FORMAT AND RESULTS

Since in the matching-to-sample tests conducted by Kersta and others a match for the "unknown" spectrogram always existed, the trial became merely a process of elimination. This type of trial has no relation to a forensic application of the technique and the results obtained through such trials cannot be extrapolated to validate the technique as a means of identification. The format of the Tosi study, however, was designed to test varying conditions which could be expected to differ and follow the sound excerpted. See Hecker, Speaker Recognition at 12-13.

Kersta, Nature at 1256, 1257.

Hennessy & Romig, supra note 20, at 190-91. See generally Hecker, Speaker Recognition at 56-73.

Neither of these extrapolative conclusions can be drawn from either the format or composition of Kersta's experiments. Because of this, Kersta's experiments are of no value for validating the technique generally. No experimental data has ever been produced to substantiate these claims, and they remain conclusory at best. Compare Kersta, Speaker Recognition and Identification by Voiceprint, supra note 17; Kersta, Nature; Kersta, Voiceprint Identification and Application, 51 FINGER PRINT & IDENT. 3 (May, 1970); Hecker, Speaker Recognition at 69-70; Ladefoged & Vandereal, The "Voiceprint" Mystique, in Working Papers in Phonetics-7 140 (1967) [hereinafter cited as Ladefoged, Mystique]. See generally Newsweek, Jan. 11, 1972, at 13; Wall Street Journal, Jan. 11, 1972, at 1, col. 3.

Ladefoged, Mystique at 140, disputes this claim. However, spectrograms have been used to successfully convict one female defendant, United States v. Phoenix, No. 70-CR-428 (S.D. Ind. April 15, 1971) (telephoned bomb threats led to authorization of arrest warrant for another, State ex rel. Trimble v. Hedman, Minn. 192 N.W.2d 432 (1971) (murder). No experimental evidence regarding the identifiability of the female voice by spectrographic analysis has yet been reported.

Hennessy & Romig, supra note 20, at 192-97. Indeed, one group of experimenters discovered that the accuracy rates for aural speaker recognition far exceeded those achieved for identification by visual analysis of speech spectrograms. Stevens, Carbonell & Woods, Speaker Authentication and Identification, 44 J. ACoustical Soc'y Am. 1596 (1968). Hennessy & Romig, supra, however, conclude that while the results of these attempted replications are in sharp contrast with Kersta's near-perfect identification scores, and thus do raise questions as to the validity of the technique, the lack of training given the examiners, the lack of uniformity in the objective points of similarity which the examiners were instructed to look for, and the use of a different spectrograph all may have seriously impaired the validity of the test results.

The Tosi study was conducted under a grant from the United States Department of Justice, Law Enforcement Assistance Administration, to the Michigan State Police. The results are summarized and explained in Tosi, et al., An Experiment on Voice Identification: Excerpts from the Report SHSLR 171 (Michigan State University, July 1971) [hereinafter cited as Tosi, Experiment]. See also Michigan Department of State Police, Voice Identification Research: A Summary of the Report to the U.S. Dept. of Justice Law Enforcement Assistance Administration (Grant No. N7-004, Feb. 1971).

Since a matching-to-sample test utilizes only closed sets, supra note 21, only one type of error existed: false identification. Error rates averaged 1% substantially the same as those experienced by Kersta. Tosi, Experiment at 19.

Hecker sets forth the major variables inherent in speaker recognition by subjective analysis of speech
have a major impact on the reliability of the technique in a forensic setting.

First, both open and closed trials were conducted and examiner-awareness of the nature of the trial was recorded. Because the examiner would never know whether the author of the “unknown” spectrogram was also included in the “known” speaker population in an objective forensic application, the importance of this variable to the technique is obvious.

Second, the effect of a reduction in cue material on identification accuracy rates was tested by presenting the examiners with nine cue-word spectrograms for each speaker in the first phase of the study, but permitting only six cue-word spectrograms for each speaker in the second phase.

A third very important feature of the Tosi study was its use of both contemporary and non-contemporary matching spectrograms in testing speaker identification. Since speech spectrography has shown that the same person rarely utters the same sound in exactly the same way, this feature of the study attempted to determine the effect of time-lapse on the ability of the examiners to make positive identification or elimination.

spectrograms. Hecker, Speaker Recognition at 56–65. See also Bolt, Reliability.

In an open trial, the speaker population against which the unknown spectrogram must be compared may or may not contain the author of the known spectrogram. In a closed trial, on the other hand, a matching spectrogram is always contained in the speaker population.

The cue-words used were: if, is, on, you, and, the, I, to, and me. A sufficient number of different sounds must be given to the examiner to enable him to judge the spectral patterns of the individual to be identified.

Overall results of the second phase did not differ significantly from those experienced in the first. Tosi, Experiment at 17–18. However, Tosi noted that increasing examiner proficiency very likely contributed to this result.

In certain of the trials, the match for the unknown speaker’s spectrogram represented a spectrogram made from an exemplar recorded contemporaneously with that representing the “unknown”. In other trials the match was a non-contemporary spectrogram, i.e., the exemplar from which the matching spectrogram was made was recorded by the same person but at a later time.

This aspect of speech is known as intraspeaker variability. The sources of intraspeaker variability are not well known, but experimental evidence suggests that aging, disease, and psychological stress may affect a person’s speech production and consequently the spectral characteristics of his speech patterns. Hecker, Speaker Recognition at 16–18, 69–70. See also notes 91–92 infra. An obvious contributor to intraspeaker variability is the environmental factor which shapes the articulation of speech. See note 11 supra.

Only non-contemporary matching spectrograms are used in a forensic application of the technique. A fourth variable tested was the effect of the context of the cue material and its mode of recording on the reliability of the technique. The cue-words from which both the “known” and “unknown” spectrographs were made were spoken first in isolation, then in a fixed context, and finally in a random context. In addition, the cue-words were recorded in three different ways: in a quiet environment directly into a tape recorder, over a telephone line in a quiet environment, and over a telephone line in a noisy environment.

In selecting a speaker population of two hundred fifty males, drawn from a population of twenty-five thousand at the university, Tosi attempted to meet one of the requirements for validation of the technique: homogeneity of the speaker group. The speakers selected had no speech de-
Effects and utilized a standard American English dialect.  

Each of the twenty-nine examiners used in the experiment was given one month of training in basic acoustic speech principles and in the interpretation of speech spectrograms. Moreover, the examiners were given several objective points of similarity to look for when making comparisons between spectrograms. This training was far more extensive than that given examiners in previous speaker recognition experiments utilizing spectrograms.

In each of the nearly thirty-five thousand random trials, aural comparison of the speech samples was prohibited. The examiner was forced to come to a positive conclusion, either rejecting or accepting one of the "known" spectrograms as identical with the "unknown", and an average time of only fifteen minutes was devoted to study of the spectrograms before a conclusion was demanded. These inhibiting factors, while necessary as a control in the experiment, would not be present in a forensic application of the technique.

Regional, dialectic or similar groups, while intraspeaker variability does not vary appreciably between homogeneous groups. Heckler, Speaker Recognition at 16. The speakers in the Tosi study were selected because they exhibited no special regional accent or other identifying characteristic. However, "homogeneity" of this speaker group was achieved on the basis of aurally perceptual similarity in speech patterns, whereas the crucial variable in spectrographic speaker recognition is the similarity in appearance of spectrograms. Unfortunately, very little is known of the perceptual and physical correlates of this type of speaker homogeneity. Id. at 57. The impact of this variable on the Tosi study as a general validation of the technique is discussed infra, notes 74–87 and accompanying text.

Although Kersta has never published a report detailing exactly which characteristics he uses to determine speaker identity, Tosi became familiar with Kersta’s methods while attending a course at Kersta’s Voiceprint Laboratories. Tosi instructed his examiners to consider the following objective points of similarity: similar mean frequencies of vowel formants, formants’ bandwidths, gaps and types of vertical striations, slopes of formants, durations, and characteristic patterns of fricatives and interformants’ energies. These factors were selected because they tend to be speaker-dependent (interspeaker variability), rather than a function of an individual’s own variation in speech patterns (intraspeaker variability). Tosi, Experiment at 9. See Foner & Fant, supra note 15, at 20; Kamhe, supra note 3, at 216.

The statistical results of the open set trials, which tested the reliability of the technique in various forensic applications, indicate that overall accuracy levels of 82–85% are possible under the conditions tested. Although these figures indicate an error range of 15–18%, this gross error rate includes two types of error: false elimination (a match was present but the examiner failed to perceive it) and false identification (a match was not present but the examiner mistakenly thought there was one, or a match was present but the examiner chose the wrong one). Only the latter error, false identification, is particularly troublesome from a legal standpoint. Moreover, a breakdown of the gross error rate to reflect the differentiation between types of error reveals that the risk of false identification is only 5–6% while that of false elimination is 10–12%.

**The Admissibility of Spectrographic Voice Identification Evidence**

Prior to publication of the results of the Tosi study two of the three appellate courts which considered the admissibility of a spectrographic voice identification had held such evidence inadmissible. In both State v. Cary and People v...
King25 the principal objection expressed to the admission of such evidence was that experimentation had not yet progressed to the point where the technique's reliability could be sufficiently demonstrated. Shortly before the King decision, however, a divided United States Court of Military Appeals in United States v. Wright26 ruled expert testimony regarding a spectrographic voice identification admissible, relying solely on Kersta's testimony as to the technique's reliability.

THE FRYE RULE

As with all other types of evidence, relevance24 is the principal determinant in the admissibility of scientific evidence.25 The relevance of proffered testimonial or tangible evidence is determined by a judicial consideration of both the materiality and probativeness of that which is offered.26 In applying these evidentiary rules to scientific evidence, including the expert testimony necessary to interpret it, courts have usually relied on scientific experts to initially approve the worth and validity of a technique, thereby assuring the court that the proffered evidence possesses at least a minimum probative value. The general rule was first set forth by the District of Columbia Circuit in Frye v. United States,27 where the court stated:

While courts will go a long way in admitting expert testimony deduced from a well-recognized scientific principle or discovery, the thing from which the deduction is made must be sufficiently established to have gained general acceptance in the particular field in which it belongs.28

The "general acceptance" test imposed by Frye has troubled many commentators in the years since its inception.29 The major argument against Frye is that a too literal application of the rule would unjustifiably tend to restrict the acceptance of new scientific techniques as admissible evidence. However, while Frye remains the foundation upon which courts base admissibility determinations in the field of scientific evidence, several modern courts have interpreted Frye's mandate in a decidedly progressive vein, attending to the spirit and policy of Frye rather than to the letter of its rule.30

In attempting to refine somewhat the "general acceptance" rule of Frye, a California appellate court in People v. Williams,31 stated:

293 F. 1013 (D.C. Cir. 1923). At issue was the admissibility of the results of a polygraph examination. The Illinois Supreme Court in People v. Jennings, 252 Ill. 534, 96 N.E. 1077 (1911), had imposed a similar test when ruling for the first time on the admissibility of fingerprint identification evidence.

In attempting to refine somewhat the "general acceptance" rule of Frye, a California appellate court in People v. Williams,31 stated:

293 F. at 1013-24 (emphasis added). With regard to expert testimony based on scientific evidence, Wigmore stated his own version of the Frye rule:

When the testimony thus appearing to the ordinary layman to lack a rational basis is founded on observations made with esoteric methods or apparatus . . . the method should be explained by the witness, and if it be vouched for in his branch of learning, it suffices to admit his testimony.2

Wigmore § 659.

See, e.g., McCormick § 170; J. Richardson, Modern Scientific Evidence § 6.18 (1963); Note, supra note 50. McCormick feels that a "general acceptance" test is appropriate only for a court's taking judicial notice of scientific facts. He would not impose such a test for determining admissibility. McCormick § 170.


The results of tests of the type here under attack, as well as opinions based thereon, are admissible only if the tests have gained acceptance in the field of learning in which they are in use.\(^6\)

Although noting that the expert witnesses had all acknowledged that it could not “truthfully be said that the medical profession as a whole” had generally accepted the test in question,\(^6\) the court concluded that:

All of the medical testimony points to the reliability of the test. It has been generally accepted by those who would be expected to be familiar with its use. In this age of specialization more should not be required.\(^6\)

A further refinement of Frye was undertaken by the court in Coppolino v. State.\(^6\) The admissibility of expert testimony relating to a novel and specially designed medical test for the presence of a certain highly toxic poison in the deceased was at issue. The court noted that prior to the discovery and use of the test by the state's expert, medical scientists believed it impossible to detect either the presence of the toxin or its component parts in the body.\(^6\) However, in upholding the trial judge's ruling admitting the testimony of experts who testified to the abnormally high presence of succinic acid, a component of the toxin, the court noted the Frye principle\(^6\) and then stated:

The problem presented to the trial judge was, were the scientific tests performed by Umberger so unreliable and scientifically unacceptable that their admission into evidence was error.\(^6\)

Coppolino thus appears to hold that if the offered evidence or testimony is based on a test or technique which is analytically and scientifically valid, then notwithstanding the relative newness of the test or technique and lack of exposure to the profession, evidence derived from it may be admitted. However, the implicit premise of Frye, Williams, and Coppolino is that judicial and scientific acceptance of a novel technique is also dependent on the capacity of the test or experiment to produce the offered results or extrapolations.\(^6\)

**THE TOSI STUDY AS A VALIDATION OF THE TECHNIQUE**

**“Scientific Acceptance”**

Completion of the Tosi study and publication of the results removed a major scientific objection to the forensic use of spectrographic voice identification: the total lack of large-scale experiments investigating the technique's reliability in circumstances similar to those found in court cases.\(^7\) In addition, the methodology employed by Tosi gave a certain statistically replicable character to his results.\(^7\) But the admissibility requirements of Frye, Williams, and Coppolino go beyond mere statistical replicability. For the Tosi study to have any positive effect on the legal status of spectrographic voice identification, the results of the study must be of a kind which permit scientific extrapolation to validate the technique as a general method of personal identification. It is Tosi's contention that the results achieved by using his relatively homogeneous speaker population can be extrapolated to so validate the technique.

Recognizing that the present state of scientific knowledge was inadequate to prove directly the theory of invariant speech upon which the validity of spectrographic voice identification depends, Tosi felt nevertheless that such proof could be obtained inferentially from a proper evaluation of empirical data derived from a well-constructed speaker identification experiment.\(^7\) However, the validity


\(^7\) Ladeoged has expressed the opinion that the Tosi study was a model piece of scientific methodology, “well designed and carried out with true scientific objectivity.” Letter, supra note 2. See authorities cited in note 32 supra.
of such an evaluation, and consequently the admissibility of evidence derived from use of the technique, is itself dependent upon the sampling and testing format of the experiment.\textsuperscript{77} Furthermore, Tosi's conclusion that the validity and reliability of spectrographic voice identification has been proven by empirical data obtained in his experiment is grounded solely on an assumption that the inter- and intraspeaker variations within a group of criminal suspects or within any other speaker group would not differ substantially from those which existed within his test group.\textsuperscript{74}

In discussing the error rates reported by Tosi, Peter Ladefoged, formerly a vehement critic of spectrographic voice identification,\textsuperscript{76} noted that errors were often the result of examiner confusion between certain pairs of voices. Conceding that if Tosi's speaker population represented a statistically valid sample of criminal suspects the relatively low error rate of 6\% false identification could be taken as a probable maximum, Ladefoged felt nonetheless that the "confusability" factor should be further examined before fully accepting all of Tosi's claims.\textsuperscript{78}

Ladefoged's hesitancy in accepting the 6\% rate for false identification as a maximum\textsuperscript{77} stems from his assessment of the homogeneity of the speaker population used in the experiment. Although Tosi was careful to achieve homogeneity in the general sound of speech patterns,\textsuperscript{79} the college males constituting the universal population, and consequently those in the sample itself, almost certainly came from different backgrounds. Because interspeaker variations in spectrographic speech patterns can be expected to be greater the more heterogeneous the speaker population,\textsuperscript{79} thus resulting in fewer confusable voices, it is debatable whether a substantially similar number of voices exist in a smaller, more homogeneous community where interspeaker variations are fewer. Although it may be reasonable, as Tosi claims,\textsuperscript{83} to assume that the variation in probabilities will not be statistically significant, that claim remains for the moment a mere hypothesis, unsupported by empirical data. It is at least questionable whether the criteria for admissibility are met by the results and extrapolations of this one study.\textsuperscript{84}

This view, that the Tosi study, although methodologically sound, simply did not go far enough was advanced by Ladefoged in testimony during the trial court's hearing on the defendant's habeas corpus petition in State ex rel. Trimble v. Hedman,\textsuperscript{72} and by two former associates of Kersta at Bell Telephone Laboratories in State v. Andretta.\textsuperscript{73} Although Ladefoged has now apparently changed his mind as to the degree to which the Tosi study validated spectrographic voice identification, Peter Denes, one of the witnesses testifying in the Andretta case and the co-author of a 1970 report\textsuperscript{85} setting forth the requirements for scientific validation of the technique, felt that the Tosi study "only goes a small way towards clearing up a very large area of uncertainty before something more definite could be said about the reliability of this method."\textsuperscript{75} Denes did not feel that the results of the Tosi study would change prior to the Tosi study that the theory of invariant speech, which appeared to underlie many of the spectrographic voice identification experiments, had not been translated into a hypothesis which could be tested with a finite population. Hecker, Speaker Recognition at 70.

\textsuperscript{73} The court in King pointed out that "[n]ecessarily, the court must analyze the sampling techniques used [and] methods of verification. . . ." 266 Cal. App. 2d at 437, 72 Cal. Rptr. at 491. See also Coppolino v. State, 73 So.2d 68 (Fla. App. 1968).

\textsuperscript{74} Tosi, Experiment at 21. See note 41 supra.

\textsuperscript{75} See Ladefoged, Mystique.

\textsuperscript{76} Letter, supra note 2. Ladefoged and Vanderslice note in their critique of Kersta's methods and technique that they have found two randomly chosen persons who exhibit remarkably similar spectrographic speech patterns. Ladefoged, Mystique at 131-33.

\textsuperscript{77} Tosi hypothesizes that if a trained examiner is permitted as much time as necessary, is given sufficient cue material, listens to both the known and unknown voice exemplars, and is permitted to rate his confidence in the identification opinion he gives, the accuracy of identification by spectrographic voice analysis will approach 100\%. Tosi, Experiment at 20. See note 49 supra.

\textsuperscript{78} See note 41 supra.

\textsuperscript{79} See note 41 supra.
in any way the negative conclusion as to the technique's scientific validity reached in the 1970 report.97

The "confusability" factor to which Ladefoged refers in his discussion of the Tosi study points up the wholly examiner-dependent nature of the reliability of spectrographic voice identification.88

The ultimate identity inference to which the expert testifies in court is derived not from scientific principles, but rather from a purely subjective comparative analysis of similarities in the sound pattern parameters exhibited on a pair or series of spectrograms. At the moment not even these similarities can be quantitatively described.89 As both Tosi and Ladefoged note,90 the ethics and training of the examiner are highly important. The examiner must be aware of and able to evaluate the relationships between spectrum variations on the spectrogram and speaker-dependent identity traits.

A further difficulty in accepting Tosi's extrapolations, apart from the fact that his experiment did not adequately test the confusability of voices or the degree to which inter- and intraspeaker variability overlap among homogeneous population groups, is that so little is understood about speaker variabilities. Speech is a studied process development, but the effect of subsequent physiological and environmental changes on the speech pattern has not yet been determined.91 Moreover, due to inherent intraspeaker variability, the causes of which have yet to be determined, no two spectrograms of phonetically identical utterances made by the same speaker are ever exactly alike. Nor is it fully understood yet what effect psychological stress, quite possibly a frequent factor in criminal acts, has on speech production. Two studies have indicated, for example, that spectrograms made of speech generated under stress conditions exhibit significant change from those generated under "normal" conditions.92

Notwithstanding these reservations about the validity of spectrographic voice identification, the scientific reaction to Tosi's study and extrapolations is in marked contrast to the feelings expressed several years ago when Kersta published his theories.93 Ladefoged, for example, has testified in court94 that the dominant view of the scientific community is presently in accord with an opinion he expressed in a letter to Dr. Edward David, Science Adviser to the President of the United

97 Id. at 14.
98 This characteristic highlights the technique's similarity to polygraph testing. Although error rates of less than 10% have been reported for the polygraph, see F. Inbau & J. Reid, Truth & Deception 226-34 (1966); Horvath & Reid, The Reliability of Polygraph Examiner Diagnosis of Truth & Deception, 62 J. Crim. L.C. & P.S. 276 (1971), neither courts nor scientists have responded favorably to this technique. Also, the nearly 50% rate of inconclusiveness experienced in many spectrographic voice analyses, see Michigan State Police, supra note 30 at 38-39, parallels the usefulness of the now debunked dermal nitrate test for gunpowder. See Turkel & Lipman, Unreliability of Dermal Nitrate Test for Gunpowder, 46 J. CRIM. L.C. & P.S. 281 (1955).
100 Tosi, Experiment at 21-22. See also letter, supra note 2.
101 Mysak, Pitch and Duration Characteristics of Older Males, 2 J. SPEECH HEARING RES. 46 (1959), found that aging is often accompanied by a rise in median fundamental frequency, greater variability in fundamental frequency, and a slight reduction in speaking rate. Sander, Maloney & Jackson, Phonatory and Related Changes with Advanced Age, 9 J. SPEECH HEARING RES. 333 (1966), speculated that the reduced range of fundamental frequency which they found associated with aging is caused by the aging of the laryngeal cartilages and muscles.
102 Various diseases of the chest, larynx and central nervous system are known to affect particular facets of speech production, but their effect on the spectral characteristics portrayed on the spectrogram is not known. See Hecker, Speaker Recognition at 18.
103 See also Kersta, Environmental Influence on the Speech of Family Members Shown by Spectrographic Speech Matching, 38 J. ACoustical Soc'y Am. 935 (1965).
104 See Hecker, Stevens, von Bismark & Williams, Manifestations of Task-Induced Stress in the Acoustic Speech Signal, 44 J. Acoustical Soc'y Am. 99 (1968); Williams & Stevens, On Determining the Emotional State of Pilots During Flight: An Exploratory Study, 40 AEROSPACE MED. 1369 (1969). Stevens has suggested that because forensic applications of spectrographic voice identification may often be made in situations where a speaker is undergoing stress, further research into the physiological and emotional correlates of the acoustic speech signal may be essential to determine the validity of the technique. Interview with Dr. Kenneth N. Stevens, Professor of Electrical Engineering, Massachusetts Institute of Technology, in Cambridge, Mass., Nov. 23, 1971.
105 The Technical Committee on Speech Communication of the Acoustical Society of America expressed alarm at its 1966 meeting at the practical infallibility attributed to spectrographic voice identification by Kersta and the popular press which reported his conclusions. See Kersta, NATURE; N.Y. Times, April 12, 1966, § 1, at 1, col. 2. Several members of the committee undertook to review the reliability of the technique and to dispel certain allusions to fingerprint identification. Their findings and recommendations for validation of the technique are presented in Bolt, Reliability 606-08. A general summary may be found in Bolt, et al., Identification of a Speaker by Speech Spectrograms, 166 SCIENCE 338 (1969).
States. Ladefoged there stated that he would accept Tosi's 6% false identification figure as a "rough estimate" of the technique's accuracy.65

Judicial Reaction

Those reported cases which have discussed the admissibility of spectrographic voice identification testimony since publication of the Tosi study have justified admitting such testimony by referring to the general rule laid down in Frye, arguing that scientific opinion of the technique is now favorable. These courts have felt that the Tosi study should be taken to validate the technique generally as a reliable method of voice identification, leaving the further unresolved questions as to voice similarity among smaller, more homogeneous groups as affecting only the weight and credibility of the identification testimony. It can be argued with some force, though, that Tosi's extrapolations, like those of Kersta, are premature. While Tosi's results are impressive, they do not support the further inference that the technique is reliable as a general principle in other than the laboratory test conditions: the quantum of reliability in other applications yet knows no limit.

Notwithstanding the readiness now of the scientific community to accept the technique, the requirement of analytical validity expressed in Coppolino is not met by an experiment which produces a range of error which is presently undefined.66

The essential underpinning of the decision in United States v. Wright,67 that unanimity among experts is not a requirement for admissibility, seems to have also formed the basis for the Minnesota Supreme Court's opinion in State ex rel. Trimble v. Hedman,68 the first reported appellate opinion to consider the impact of the Tosi study. It was there held that a voice identification by spectrographic voice analysis, if corroborated by aural identification, was of sufficient probative value to form probable cause for the issuance of an arrest warrant for a young woman. Although the procedural posture of the case69 prevented the court from ruling squarely on the question of the admissibility of such evidence, the court indicated that it felt spectrographic voice identification was sufficiently accepted in the scientific community to warrant the admissibility at trial of expert testimony based thereon.100

Ladefoged, testifying for the defense in the original habeas corpus hearing, stated that although he and other members of the scientific community accepted Tosi's experiments as far as they went,101 he would exercise more caution in extrapolating those results to prove the general validity and reliability of the technique. In his testimony for the state, Tosi disagreed, claiming that provided the examiner is properly trained, listens to the speech samples to be compared spectrographically, and is permitted to spend as much time as he requires, the technique is highly reliable.102 Tosi also disagreed with Ladefoged's contention that the sex of the speaker impaired the technique's reliability in any way.

With regard to the degree of reliability required of a scientific technique, the court noted that mere disagreement over the fallibility of a scientific technique would not render an expert's opinion, based on the technique, inadmissible.103—Minn. at ___, 192 N.W.2d 432 (1971).

91...Minn. at ___, 192 N.W.2d at 440. While the general proposition stated by the court is true, applied here it is merely conclusory. If the scientific community, or even the specialty field, is divided equally, the probative

92 Minn. at ___, 192 N.W.2d at 444. In the trial subsequent to the Minnesota court's opinion, Trimble did not contest the admission into evidence of the voice identification. Instead, she took the stand and testified that although it was she who placed the call, she was unaware that criminal acts might result. Letter from Assistant Ramsey County Attorney Paul E. Lindholm to the author, May 12, 1972, on file in the editorial offices of the Journal of Criminal Law, Criminology & Police Science.

93 Minn. at ___, 192 N.W.2d at 440.

94 Id. at ___, 192 N.W.2d at 439.

95 Id. at ___, 192 N.W.2d at 440. While the general proposition stated by the court is true, applied here it is merely conclusory. If the scientific community, or even the specialty field, is divided equally, the probative

96 The text of Ladefoged's opinion reads, in pertinent part:

If I were asked to testify on the validity of the system, I would have to emphasize that we do not at the moment know the probable error rate. But I would accept a minimum of 6% as a rough estimate of the possibility of making a misidentification (assuming, of course, that there was no question of women, mimics, or disguised voices being involved, and that the identification had been made by an experienced, responsible, investigator).

Letter, supra note 2 (emphasis added).

97 All evidence, must, of course, be probative. See note 56 supra. When there is no support for the proposition that a technique is accurate within certain tolerance limits, the probativeness of evidence based on the technique is substantially reduced. A strong argument can be made that such evidence should be "excluded because altogether lacking in probative value." See Coolidge v. New Hampshire, 403 U.S. 443, 448 n.2 (1971), citing Tribe, supra note 18, at 1342 n.40. See also note 81 supra.

though the Trimble court was correct in stating that the infallibility of a scientific technique or device is not a prerequisite to admissibility, the expected rate of error is a matter to be considered in deciding whether to admit identification testimony based on a novel technique. If Ladefoged’s reservation regarding the confusability of voices in other samplings is valid, then the expected rate of error has only a likely minimum, with no real evidence to sustain a probable maximum.

While theTrimble court recognized that the precise question before it was narrower than the broader admissibility issue faced by Cary, King, and Wright, it nevertheless noted that:

[In the trial of the case spectrograms [sic] ought to be admissible for the purpose of corroborating voice identification by aural means if a sufficient foundation is laid to satisfy the trial judge that the expert whose opinion is sought is qualified to assist the fact finder in coming to the right conclusion.]

This statement, although dicta, has already had substantial legal effect. The court seemed convinced that the technique had advanced to the point where judicial notice could be taken of its reliability, the only bar to its admissibility being its use by an unqualified voice identification expert.

At least two federal courts have followed the lead of the Minnesota Supreme Court. In United States v. Phoenix the trial judge admitted evidence of a spectrographic identification after hearing extensive testimony by both Tosi and Ernest Nash, a voice identification expert with the Michigan State Police. In a written opinion, a District of Columbia trial judge in United States v. Ray⽤．

It is doubtful that infallibility for a scientific technique is or should be a prerequisite for its admissibility. See 3 Wigmore § 950; McCormick, Deception Tests and the Law of Evidence, 15 Calif. L. Rev. 484, 500 (1927).

See note 88 supra.

Minn. at __, 192 N.W.2d at 444 (emphasis added).


No. 70-CR-428 (S.D. Ind. April 15, 1971).
the matter, has not moved to accept spectrographic voice identification in other than investigative situations.\footnote{113}

A recent New Jersey case, State v. Andretta,\footnote{114} however, has adhered to the exclusionary result reached by the court in State v. Cary. Despite the precedent set by Trimble and Raymond, both cited in the opinion, and the radical change in scientific thought on the technique's accuracy and reliability as a result of the Tosi study, the court noted that:

The evidence offered for the purpose of showing scientific acceptance did not go so far as to include acceptance of the proposition that the technique would result in a scientifically reliable identification or elimination by the expert, but "merely that the study of Dr. Tosi, so far as it went, was conducted in accordance with valid scientific standards."\footnote{115}

The court in Andretta was not presented squarely with an admissibility question. Rather, the state had requested a court order to compel the defendants in the case to submit voice exemplars for spectrographic comparison with spectrograms made from exemplars taken nearly four years before. The court was unimpressed with the testimony of Tosi, Ladefoged, and Nash that time-lapses of greater than one month would have no appreciable effect on the accuracy of an examiner's identification or elimination. Because the Tosi study had only tested the effect of a one month time-lapse on the accuracy of the technique, the court did not feel that the further inference that no statistically significant differences would be found in greater time-lapse situations could be drawn.\footnote{116}

The late FBI Director J. Edgar Hoover stated, in response to a request for FBI policy on the question, that in view of the many unresolved questions which may strike at the heart of the technique's reliability: [W]e feel that the comparison of voiceprints is useful as an investigative guide but has not been proven sufficiently well authenticated to serve as a reliable basis for expert testimony, as to identity, at this time.


Conclusion

The Tosi study and the scientific respect accorded it clearly go a long way toward establishing spectrographic voice analysis as a reliable method of voice identification. Since the technique may be used to exclude\footnote{119} as well as to identify, its forensic applicability will benefit prosecution and defense alike.

Although recent case law supports the admissibility of such identification testimony, there are significant unquantified variables which may have an as yet undetermined effect on the accuracy and reliability of spectrographic voice analysis. The courts ought to look carefully at the evidence marshalled to support the general admissibility of such an identification until further experimentation establishes the relationship which these variables have on the examiner's proficiency. While the technique certainly possesses sufficient reliability to render an identification admissible on stipulation, at least in those jurisdictions which allow such use of polygraph test results,\footnote{120} the courts ought not be too eager to embrace a technique which has only recently been rescued from an abyss of scientific scorn—a rescue accomplished by the narrow experimental data produced in one study.

Even in those jurisdictions where evidence of a spectrographic voice identification is adjudged admissible, the bench or jury can and should be made fully aware of the inadequate knowledge speech scientists have of the many factors which influence speech production. While the fact finder is entitled to have before it all available data which possesses a reasonable level of probativeness, the danger of prejudice in using a technique, the accuracy of which is so heavily dependent on undefined variables and the ethics, training, and general responsibility of the examiner, would seem to tip the scales toward exclusion, notwithstanding the technique's "scientific acceptance." Courts cannot wave Frye as a talisman directing admissibility; they may not abdicate their responsibilities by blindly following general scientific acceptance.

\footnote{117} See note 112 supra.\footnote{118} See, e.g., State v. Valdez, 91 Ariz. 274, 371 P.2d 894 (1962). The Valdez opinion, however, conditioned even this restricted use of the polygraph technique's results on requirements that the court and jury be made fully aware of the possibilities for error inherent in the technique.
SKYJACKING:
CONSTITUTIONAL PROBLEMS RAISED BY
ANTI-HIJACKING SYSTEMS

The introduction of anti-hijacking systems using magnetometers and passenger profile analyses raises familiar constitutional issues in a new context. These systems, which were designed to identify weapon-carrying skyjackers, have also proved useful for spotting other kinds of lawbreakers, including narcotics violators and aliens who have entered the United States illegally.

1 A magnetometer is a metal detecting device. It is installed in the passageway leading to an airplane for the purpose of detecting passengers who are carrying objects of a certain weight metal. There are different types of magnetometers but all are set to give some kind of signal when such a metal object is carried past. See United States v. Lopez, 328 F. Supp. 1077, 1085 (E.D.N.Y. 1971).

2 The profile analysis was developed by a government task force which used statistical, sociological, and psychological data and techniques to discover certain characteristics thought to set hijackers apart from other air passengers. See id. at 1086. According to the Lopez court a passenger who meets the profile requirements is focused on by airline employees; if he also triggers the magnetometer he is then "interviewed" by airline personnel. If he cannot produce satisfactory identification a United States Marshal is summoned to search him. Id. at 1083. According to one sample, of 500,000 screened passengers .28% (1,406) satisfied the profile. Half of these passengers were allowed to board immediately because they did not activate the magnetometer, leaving 712 or .14% to be interviewed. Of those interviewed about one third (283) were actually airline personnel.

3 According to figures released by Wayne B. Colburn, Director of the United States Marshals Service (a branch of the United States Department of Justice), 1,926 arrests were made between October 15, 1969, the beginning of the Marshals Service Air Piracy Program, and December 15, 1971. Of these, 205 persons were arrested for possession of concealed firearms and 133 for possession of other concealed deadly weapons. Five hundred thirty-eight persons were arrested for possession of narcotics and about the same number were arrested as illegal aliens, while about 300 were arrested for attempting to board an airplane with a firearm.

Questions relating to fourth, fifth, and sixth amendment rights have been raised in connection with these anti-hijacking systems as well as issues relating to the right to travel.4 It is the purpose of this comment to discuss these issues as they relate to anti-hijacking systems and to determine whether these systems interfere with fundamental constitutional rights of air passengers—and, if so, to what extent such interference may be justified.

A recent district court case, United States v. Lopez2, considered these questions. The court upheld the use of a particular anti-hijacking system but suppressed heroin found on the defendant as a result of its use because the "elegant and objective" system devised by the government to deter and apprehend hijackers was distorted in an "irrational and prejudicial" way by airline personnel.7

The court heard facts and arguments concerning a profile analysis system which the airline used,4 although there is no explicit mention of this right in the Constitution, it has long been recognized as a basic right and has been variously construed as coming under the privileges and immunities clause, U.S. Const. art. IV, § 2, the commerce clause, U.S. Const. art. I, § 8, and the fifth and fourteenth amendments. See Shapiro v. Thompson, 394 U.S. 618 (1969); United States v. Guest, 383 U.S. 745 (1966); Edwards v. California, 314 U.S. 160 (1941).


6 In 1968 a task force was appointed to consider methods of curtailing hijackings. Included on the task force were representatives from the Federal Aeronautics Administration, the Justice Department and the Commerce Department. They researched the characteristics of all known hijackers and found that they shared certain characteristics which set them apart from the rest of the air traveling public. On the basis of these findings the group recommended certain procedures to try to deter hijackings, including use of a magnetometer to identify those passengers carrying metal and a profile analysis based on the characteristics which the group felt were peculiar to hijackers. See id. at 1082–83.

7 Id. at 1081, 1101. A Pan American passenger service manager had issued a memorandum purporting to "update" the profile analysis in an unauthorized manner. In so doing, the agent eliminated one characteristic which the court considered fundamental and added two others which the court found unacceptable. One introduced an ethnic element for which there was no experimental basis, creating an equal protection problem, and the other required an act of individual judgment by airline employees which the court concluded destroyed the neutrality and objectivity of the approved profile.

8 This profile, resulting from the task force study,
but excluded the public and the defendant from this part of the trial, thus raising a sixth amendment question. The court concluded that the exclusion of the public and defendant was justified because of the dangers involved in revealing such information. The court also disposed of a fifth amendment question; it determined that the characteristics included in the profile were not discriminatory and that the profile when properly used did not violate equal protection standards. On the fourth amendment question of the search itself, the court said there was no implied consent, as the government contended, nor was the search incident to an arrest; however, the court held that it was justified under Terry v. Ohio as a protective search for weapons. Although admitting that use of such a system is "disquieting," the court held that contraband seized as a result of a proper investigatory search based on information generated by a well administered federal anti-hijacking system is admissible as evidence.

In Lopez the evidence was suppressed because the system was altered by an airline employee. If this had not occurred, however, there were several constitutional grounds on which the defendant could have appealed.

EXCLUSION FROM THE COURTHROOM

The first constitutional ground concerns the exclusion of the public and the defendant from the part of the trial involving testimony on the profile analysis system used by the airlines. The sixth amendment guarantees all criminal defendants the right to a public trial. In addition to furnishing protection for the accused, this right has been construed as a protection of a public interest—the right of the public to know what occurs at criminal trials. Despite the general presumption that criminal defendants are entitled to a public trial, courts have upheld many exceptions. Courts are 

1 See note 7 supra.
2 See note 9 supra. This practice has its roots in the English common law and was established in several states even before the sixth amendment was ratified in 1791. In re Oliver, 333 U.S. 257, 266-67 (1948), discussing the history and development of this right. See also Lewis v. Peyton, 352 F.2d 791 (4th Cir. 1965). In Estes v. Texas, 381 U.S. 332 (1965), the Court stated:

We start with the proposition that it is a "public trial" that the Sixth Amendment guarantees to the "accused." The purpose of the requirement of a public trial was to guarantee that the accused would be fairly dealt with and not unjustly condemned. History has proved that secret tribunals were effective instruments of oppression.

Id. at 538-39.

In holding that the defendant's right to a public trial was violated when the judge excluded the public from a home where he and court officials had gone to take testimony, the reviewing court in Lewis v. Peyton, 352 F.2d 791 (4th Cir. 1965), stated that the right to a public trial is not solely for the protection of the accused but is also for protection of the public's right to know what occurs in criminal trials because a secret trial can result in favor to as well as unjust prosecution of a defendant. Thus we would be loath to hold that an accused may waive his right to a public trial. 

Id. at 792.

One of the most common reasons for exclusion of the public is the preservation of order in the courtroom. See United States ex rel. Orlando v. Fay, 350 F.2d 967 (2d Cir. 1965), cert. denied sub nom. Orlando v. Follette, 384 U.S. 1008 (1966). See also United States ex rel. Bruno v. Herold, 408 F.2d 125 (2d Cir. 1969), cert. denied, 397 U.S. 957 (1970). At times courts have held that restrictions on certain individuals were necessary, particularly members of the press and other news media. See Sheppard v. Maxwell, 384 U.S. 333 (1966); Estes v. Texas, 381 U.S. 532 (1965); Geise v. United
less likely, however, to allow exclusion of the defendant himself in criminal cases. Defendants are entitled to be present at their trials under the due process clauses of the fifth and fourteenth amendments and the confrontation clause of the sixth amendment. However, this right to be present is not absolute.

The *Lopes* court found its main support for excluding the defendant from *in camera* hearings on the anti-hijacking system by drawing an analogy to cases in which the government is allowed to protect the identity of an informer. Under the informer privilege the government may refuse to reveal the identity of a person who has furnished a law enforcement officer with information on an alleged crime. There are certain limitations to this rule. First, the privilege applies only to the identity of the informer and not to the contents of his communication. Second, no privilege exists if the identity of the informer is known by those who would have cause to resent the communication.

The *Grable* court found its main support for excluding the defendant from the trial because of his own disruptive conduct.

Third, even when the privilege is applicable, the court may compel disclosure if it appears necessary for a fair determination of a relevant issue.

It is difficult to apply the court’s informer analogy to hijacking cases. It is not the identity of the informer which is in issue—the system itself is the informer and it is known that the system is composed of a magnetometer and a profile analysis. What is in issue is the basis for relying on the system—the system’s contents which direct the singling out of a particular individual. Under the informer rule contents of a communication are not privileged. If disclosure of the contents of his statement would tend to disclose the identity of the informer the communication could come within the privilege, but only to the extent necessary to preserve the informant’s anonymity.

Even if the privilege were construed to include contents as well as identity it should not be sustained in hijacking cases. In *Roviaro v. United States* the Court held:

> Where the disclosure of an informer’s identity, or of the contents of his communication, is relevant to the charge, the court may compel disclosure if it appears necessary for a fair determination of a relevant issue.

In Illinois v. Allen, 397 U.S. 337 (1970), the Supreme Court held that since the informer was already identified the privilege was no longer applicable because it was limited only to his identity and did not extend to his communication.

The Supreme Court in *Roviaro v. United States*, 353 U.S. 53 (1957), reversed the defendant’s conviction because of the government’s refusal to identify the informant, stating that when such identity is relevant or helpful to the defense the privilege cannot be invoked.

The court stated that the anti-hijacking system itself acts as an informant and noted that the reliability of the information which it gives depends on the nature of the profile and how well it is applied by airline personnel. The court added that there is a stronger case for nondisclosure to the defendant because the informant is an objective system whose credibility the defendant could not impugn by his presence. 328 F. Supp. at 1092. However, the court ignored the fact that if the defendant knew the characteristics in the profile he might be able to argue that he did not fit them and therefore the profile was not properly applied by airline personnel. He also could argue that the characteristics chosen were discriminatory and he could present witnesses in an attempt to show that there was an inadequate foundation for their inclusion in the profile.

The main reason for protecting the identity of informants is to encourage them to come forward with information without fear of retributions. See, e.g., *McCray v. Illinois*, 386 U.S. 300 (1967).

This information is analogous to the contents of an informant’s report, i.e., his reasons for believing that a crime has been committed by a particular person.

See note 25 supra.

*8 Wigmore* § 2374. There is an exception to this rule in cases where the communication, on its own merits, qualifies as a military or state secret. See 8 Wigmore § 2378; text accompanying notes 37–39 infra.

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*COMMENT*
and helpful to the defense of an accused, or is essential to a fair determination of a cause, the privilege must give way.\textsuperscript{34}

There are considerable possibilities for misuse or abuse of anti-hijacking systems.\textsuperscript{35} Knowledge of the contents of the profile would help guard against misuse. Such information is necessary to establish the system's basic reliability and fairness and to determine whether it was properly applied in a given case. This information is essential to determine whether the classifications within the profile meet the standards of the equal protection clause.\textsuperscript{36}

\textsuperscript{34} Id. at 60-61. The Court added that there should be no fixed rule, but the question of whether a proper balance renders nondisclosure erroneous depends on the circumstances, considering such factors as the crime charged, the possible significance of an informant's testimony, Id. at 62. But see McCray v. Illinois, 386 U.S. 300 (1967), in which the Court upheld the refusal to compel disclosure of an informant's identity in a preliminary hearing to establish probable cause for arrest and search. The Court distinguished \textit{Roviaro} by saying that it involved not a preliminary hearing, but the trial itself, and that the disclosure in \textit{Roviaro} went more directly to the issue of guilt or innocence than that in \textit{McCray}. Id. at 309. See People v. Nettles, 34 Ill. 2d 332, 213 N.E.2d 536 (1966); People v. Durr, 28 Ill. 2d 308, 192 N.E.2d 379 (1963). See also United States v. Santell, 420 F.2d 623 (3d Cir. 1970); United States v. Jackson, 384 F.2d 825 (3d Cir. 1967), cert. denied, 392 U.S. 932 (1968).

\textsuperscript{35} There is a fundamental question as to whether any system based solely on machines and statistical data which physically and psychologically analyzes a group of unsuspecting citizens, before any crime has taken place, should be upheld as a justification for searching selected individuals. The \textit{Lopez} court recognized this, noting that under our criminal law people are not condemned because they are potentially dangerous but are prosecuted only for illegal acts. However, without explaining why, the court concluded that in this case no such result was accomplished. 328 F. Supp. at 1100. But cf. Tribe, \textit{An Ounce of Detention: Preventive Justice in the World of John Mitchell}, 56 VA. L. REV. 371 (1970). The use of machines, scientific tests and statistics for purposes of gathering and serving as evidence at trials raises additional problems. See notes 63, 69 infra. There is the possibility that the system could be devised to trap other law violators (such as narcotics possessors) under the guise of searching for hijackers. Many more narcotics violators have been caught by the system than weapons carriers. See note 3 supra. Even if the system is carefully devised to be reliable and fair, there is always the danger that it will be misused by the people who operate or apply it. It is difficult to insure against misuse resulting from individual suspicions and prejudices. The \textit{Lopez} court noted that continuous supervision of persons having this power was essential and that the system required evaluation in light of the skill and dedication of those operating it. (328 F. Supp. at 1101-02.) However, the court did not set any specific standards.

\textsuperscript{36} Courts have held that "invidious distinctions" and classifications depriving people of basic rights without a compelling governmental interest violate the equal protection clause. In hijacking cases neither the public nor defendant has knowledge of the characteris-
certain reports relating to a criminal case, saying:

The government must choose; either it must leave
the transactions in the obscurity from which a trial
will draw them, or it must expose them fully. Nor
does it seem to us possible to draw any line between
documents whose contents bear directly upon the
criminal transactions, and those which may be only
indirectly relevant.41

Thus one of the same reasons for not allowing ex-
clusions under the informer rule—because the
material pertains to a relevant issue in the deter-
mination of guilt or innocence in a criminal trial—
is a reason to refuse exclusion under the military
and state secrets rule.

Neither the informer privilege nor the state
secrets doctrine clearly applies as a basis for exclud-
ing the defendant and public in such a case. Yet
there is an undeniable danger to the usefulness of
the system—and thus to the air traveling public—
if the contents of the system are revealed. As a
matter of public policy and necessity perhaps a new
rule is needed, using the analogy to the state and
military secrets rule as a basis for justifying some
incursion into constitutionally protected areas.

A balancing test should be used42 in determining
whether, even though such cases do not come under
a specific established exception, the immediate
danger to the public outweighs the traditional rule
that defendants and the public have a right to be
present at criminal trials. In applying this balanc-
ing test, some interrelated constitutional problems
should be considered.

SEARCH AND SEIZURE

The fourth amendment requirement of probable
cause43 raises serious questions about the use of
anti-hijacking systems and resulting searches.
There are several exceptions to the general require-
ment of probable cause to search. When an officer
reasonably believes that an individual whose sus-
picious behavior he is investigating might be
armed, he may conduct a self-protective search.44
A search is also allowed without a warrant if it is
incident to a lawful arrest,45 and searches are al-
lowed when made with the suspect's voluntary and
knowledgeable consent.46

The exception for situations in which a search
is incident to a lawful arrest would not apply in hi-
jacking cases. The arrest does not occur until after
the search has been completed.47 Evidence found
in a search may not be used as justification for an
arrest if there was not prior cause for the search.48
The Lopes court rejected the notion of implied con-
sent, stating that the government could not condi-
tion the defendant's right to travel on the volun-
tary relinquishment of his fourth amendment
rights.49

Instead the court relied on the standard set forth
in Terry v. Ohio40 allowing a self-protective search
for weapons by a police officer who reasonably be-
lieves that an individual whose suspicious behavior
he is investigating may be armed. The Terry
court emphasized that the central inquiry under the
fourth amendment is the "reasonableness in all
the circumstances" of the particular invasion of
the citizen's personal security. The Court noted
whether such action is called a "stop and frisk" or a "search and seizure," it is nonetheless
clearly within the purview of the fourth amend-
ment, and, being a "serious intrusion upon the

41 Id. at 506. But cf. United States v. Reynolds, 345
U.S. 1 (1953), a civil case based on a tort claim against
the government, in which the Court said:
In each case, the showing of necessity which is
made will determine how far the court should probe
in satisfying itself that the occasion for invoking the
privilege is appropriate. Where there is a strong
showing of necessity, the claim of privilege should
not be lightly accepted, but even the most compel-
ling necessity cannot overcome the claim of privi-
lege if the court is ultimately satisfied that mili-
tary secrets are at stake.
Id. at 11. The Court indicated that a different rule
might apply in a criminal case. However, it did not
decide that question.
42 See United States v. Reynolds, 345 U.S. 1, 11
(1953); United States v. Andolschek, 142 F.2d 503, 506
(2d Cir. 1944).
43 See note 13 supra.
44 See United States v. Andolschek, 142 F.2d 503, 506
(2d Cir. 1944); United States v. Thompson, 394 U.S. 618 (1969); United States v. Guest, 383 U.S.
745 (1966); Apthecker v. Secretary of State, 378 U.S.
45 392 U.S. 1 (1968).
46 Id. at 19.
sanctity of the person," is not to be undertaken lightly by police officers. According to the Court, in determining whether the officer acted reasonably due weight must be given, not to his inchoate and unparticularized suspicion or "hunch," but to the specific reasonable inferences which he is entitled to draw from the facts in light of his experience.

The Terry Court set forth a dual test for deciding whether the search and seizure were reasonable—first, was the officer's action justified at its inception, and second, was it reasonably related in scope to the circumstances which justified the interference. In assessing the reasonableness of the officer's conduct, the Court said it was first necessary to examine the governmental interest allegedly justifying the intrusion, for "there is no ready test for determining reasonableness other than by balancing the need to search (or seize) against the invasion which the search (or seizure) entails." The Court said that a search without probable cause to arrest must be limited strictly to that which is necessary for discovery of weapons which could be used against the officer or others nearby.

Thus, under Terry standards there must be some prior indication of danger in order for an officer to stop a suspect and search him, though it need not be so strong as is required for probable cause to arrest a suspect. The Lopez court admitted that mere statistical evidence alone could not justify a search and if it were known that 6% of the people in a given community carried guns, the police would not be justified in stopping and searching people on the street arbitrarily to determine whether they had weapons. Discussing the anti-hijacking system, the Court noted that one out of every 15 persons searched is armed—a probability of about 6%—and concluded that because of "the substantial interest in preserving the integrity and safety of air travel" a 6% danger of weapons was sufficient to justify a frisk. However, the Terry Court specifically stated that a cursory weapons search had to be based on something more than an inarticulate hunch. In hijacking cases, the indication of danger is furnished solely by the profile analysis and the magnetometer, the actual scientific value of the latter being very slight. It is quite possible that...
more violators could be found as a result of "inarticulate hunches" than through use of the "scientific" system used by the airlines. The fact that 94% of the people designated as weapon-carrying hijackers by the system turn out not to be armed raises a serious doubt as to the system’s efficacy.

Without more details about the profile analysis it is not possible for the defendant or the public to be certain that the proper balance has been struck between individual rights and public safety under the current anti-hijacking system. Apparently both must accept the court’s independent findings that the characteristics of the analysis are not discriminatory in any way and that they bear a substantial relation to actual, observable characteristics of hijackers. Giving a description of known hijackers in 24 specific cases one writer noted:

With this refined intelligence, we can now pinpoint your problem passenger. First, we can eliminate, thus far, people under 16 or over 60. Using the generic "he" the skyjacker is detailed as follows:

Age 16 to 60, Caucasian, Latin or (B)lack, male or female, alone or in groups, with or without children, generally of unobtrusive dress but occasionally well or gaudily or poorly dressed, clean shaven or bearded.

Although the Lopez court was persuaded that the characteristics of the potential hijackers chosen for the profile were well-calculated to eliminate safe persons while isolating those likely to be dangerous this assumption is questionable in light of known information about actual hijackers and also considering the fact that 14 out of 15 people selected by this "scientific" system proved not to be armed. Statistics such as those used by the court can be misleading. There is no indication of how many people would be found carrying weapons in a random street sampling. It is also not known whether more people carrying weapons onto airplanes could be picked out on the basis of "hunches" which were specifically disallowed in Terry.

In addition to the problems inherent in the Lopez court’s balancing test there is an additional flaw in its reliance on Terry’s protective search rationale. Stating that a United States Marshal would be imprudent if he did not heed the warning “given to him by the system," the Lopez court held that a narrowly circumscribed protective weapons “pat-down” is constitutionally permissible under those circumstances. The court did not mention the fact that the Terry holding on which it relied was strictly limited to a situation in which a police officer personally observed unusual conduct which,

63 328 F. Supp. at 1084.
64 See Tothman, supra note 65, at 252–53.
65 328 F. Supp. at 1084.
67 392 U.S. at 27.
68 328 F. Supp. at 1097.
69 The court stated: Thus the only exception to the warrant rule under which the search of this defendant can be justified is the protective “frisk” for weapons authorized by Terry v. Ohio.
Id. at 1093.
in light of his experience, reasonably led him to believe that criminal conduct could be imminent and that the persons involved might be armed and dangerous. The court emphasized the statement in *Terry* that a frisk could be justified on the ground it was necessary "to protect himself and others from possible danger," to support its finding that it is not "significant" that frisks are normally intended to protect officers against assaults while they are interviewing a suspect, while anti-hijacking frisks take place after the preliminary questioning. The "others" mentioned in *Terry* referred to bystanders who might be injured during an interrogation by a policeman and not to members of society in general who might be injured in connection with some specific criminal activity of the suspect. The fact that the search is not conducted until after the initial period of interrogation takes hijacking cases out of the realm of self-protective frisks for weapons by police officers. The admission that the search is for protection of passengers removes such cases one step further from the self-protective weapons search sanctioned in *Terry*.

Although the *Terry* analogy relied on by the court is not satisfactory, another ground, rejected by the court, provides better justification for allowing a weapons search of airline passengers. This ground is implied consent to be searched. The *Lopez* court rightly indicated that there is generally a presumption against consent and it cannot lightly be assumed that a suspect selected by an anti-hijacking system has voluntarily agreed to be searched by the officer who is called to question him. He might at that point believe that he is under arrest and feel that he has little choice.

Nevertheless, there is one factor which lends some weight to a theory of implied consent in such cases. Conspicuous warnings are posted at boarding gates and elsewhere in airports warning passengers that "Carrying Concealed Weapons Aboard Aircraft Is Punishable by Prison Sentences & Fines" and "Passengers and Baggage Subject to Search." Though not furnishing adequate warning that any other contraband might be seized, these signs would clearly indicate to a person carrying a weapon that he is committing an illegal act if he tries to board an airplane with it, and he is given notice that he is subject to search for such an article. If after this warning he attempts to board the airplane, he could be considered to have impliedly consented to the search by this voluntary act of boarding. Therefore the consent is given when he attempts to board and not at the time he is being questioned by an officer.

**RIGHT TO TRAVEL**

The *Lopez* court stated that the government could not condition the defendant's constitutional right to travel on the voluntary relinquishment of his fourth amendment rights. However, no one could argue that the right to travel of anyone, at any time, in any manner and by any means is absolute. Though unwilling to infer consent, the court was willing to interfere with this right to travel on the questionable basis of the *Terry* rationale. According to the court anyone designated as a "selectee" by the anti-hijacking system could be denied boarding and furthermore could be denied boarding.

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77 See *Lopez*, 328 F. Supp. at 1083, 1092.
78 According to newspaper reports these signs appear to have a definite deterrent effect. Airline security men and U.S. Marshals have reported finding guns and other weapons stashed among potted palms and elsewhere in airport terminals, apparently put there to avoid detection at boarding gates. Wall Street Journal, Sept. 21, 1971, at 1; Chicago Tribune, Dec. 5, 1971, §10, at 6, col. 1.
79 See note 49 supra.
80 328 F. Supp. at 1083.
tained even if he decided at that point not to board the airplane.\footnote{Id. at 1093. The Court noted testimony of two Marshals that the defendant was not free to go at any time after they began interviewing him, to support its view that "consent" given by a defendant could not be vitiated by a reversal of his decision to board the airplane. See also United States v. Brown, 305 F. Supp. 415, 417-18 (1969), in which the defendant's motion for acquittal on grounds that his acts did not constitute an attempt to board an aircraft was rejected by the court even though he had not yet started to board the airplane. The court held that the surrendering of his ticket at the customer service agent's desk and his subsequent entry into the departure lounge for the flight covered by that ticket constituted an attempt to board the aircraft. The offense, attempt to board an aircraft with a concealed weapon, had already been committed and he was not free at that time to change his mind and leave the boarding area. See generally Fed. Av. Act of 1958 \S 902(1), 49 U.S.C. \S 1472(1) (1970).
}

Persons entering the United States are subject to search at its borders.\footnote{See United States v. Avey, 428 F.2d 1159 (9th Cir. 1970); United States v. Miranda 426 F.2d 283 (9th Cir. 1970); 19 U.S.C. \S\S 1581, 1582 (1970). See also Note, Border Searches and the Fourth Amendment, 77 Yale L. J. 1007 (1968).
} Implied consent statutes for drunken drivers have been enacted in all 50 states and have consistently been upheld, even though they restrict travel.\footnote{These statutes furnish a precedent for extending implied consent to an area involving the constitutional right to travel. A driver is assumed to have consented to a test to determine the amount of alcohol he has consumed as a condition of holding a driver's license. If a driver refuses to submit to such a test his driver's license may be revoked or suspended. This practice has been held constitutional. See Fallis v. Dept. of Motor Vehicles, 264 Cal. App. 2d 373, 70 Cal. Rptr. 595 (1968); Prucha v. Dept. of Motor Vehicles, 172 Neb. 415, 110 N.W.2d 75 (1961); Anderson v. Macduff, 208 Misc. 271, 143 N.Y.S.2d 257 (1955); Walton v. City of Roanoke, 204 Va. 678, 133 S.E.2d 315 (1963).
} In passport cases, courts have held that restrictions on travel were justified by considerations of national security.\footnote{In denying the appellant's request for validation of his passport for travel to Cuba the Court in Zemel v. Rusk, 381 U.S. 1 (1965) stated: 'The fact that a liberty cannot be inhibited without due process of law does not mean that it can under no circumstances be inhibited. The requirements of due process are a function not only of the extent of the governmental restriction imposed, but also of the extent of the necessity for the restriction. Id. at 14.
} Because of the danger element involved, the passport cases are more analogous to hijacking cases than others such as Shapiro v. Thompson,\footnote{394 U.S. 618 (1969).
} a case related to a right to reside in a particular place rather than a specific right involving the process of traveling from one place to another. This is not to indicate that the right involved in actual traveling is not also fundamental,\footnote{In United States v. Guest, 383 U.S. 745 (1966), the Court stated: 'The constitutional right to travel from one state to another, and necessarily to use the highways and other instrumentalities of interstate commerce in doing so, occupies a position fundamental to the concept of our Federal Union. It is a right that has been firmly established and repeatedly recognized. Id. at 757.
} but the passport cases clearly indicate that there are circumstances which may justify restrictions. In Zemel v. Rusk\footnote{See 381 U.S. 1 (1965).
} the Court approved the Secretary of State's conclusion that travel to Cuba by an American citizen might involve the United States in a dangerous international incident and therefore validation of his passport for such travel was properly refused.\footnote{The Court cited precedents for upholding such a restriction on travel. Beginning in 1914 and continuing through World War I passports were validated only for specific purposes and specific countries. Area restrictions have also been imposed on numerous occasions since World War II. Id. at 8-10.
} The Court distinguished cases such as Kent v. Dulles\footnote{357 U.S. 116 (1958).
} and Apthecker v. Secretary of State,\footnote{378 U.S. 500 (1964).
} where restrictions on right to travel were struck down. In those cases the issue was whether a citizen could be denied a passport because of his political beliefs or associations while in Zemel the restriction was based on foreign policy considerations which affected all citizens.

The Zemel reasoning is applicable to hijacking cases. Under the system now required by the government all persons are subject to some kind of initial screening.\footnote{A new federal rule went into effect in February, 1972, requiring some kind of screening of all airline passengers. The Federal Aviation administration rule requires that airline personnel or federal employees screen every passenger at boarding time by using at least one of four methods—magnetometer, behavioral profile, demand for identification or search. Additional federal anti-hijacking regulations were announced March 11, 1972 by Transportation Secretary John Volpe, but according to newspaper reports these requirements have largely been ignored by airlines. See Chicago Today, April 19, 1972, at 18 col. 1.; Wall Street Journal, April 19, 1972 at 9, col. 2.
} The rationale for the screening and consequent searches is related to foreign policy considerations as well as concern for public safety. There is clearly a legitimate governmental interest in preventing diversions of airplanes which could develop into conflicts with other nations.

**Conclusion**

Since it is a federal crime to carry a concealed weapon aboard an aircraft, the governmental restrictions imposed on travel are justified by considerations of national security. They have been repeatedly upheld and have served to protect the public from the danger element involved in hijacking and to prevent the United States from involvement in international incidents such as the one involved in Zemel v. Rusk. It is clear that the right involved is one of actual traveling and not merely crossing a state line or even crossing an international border. As such, it is not a fundamental rights issue, but it is clearly an important practical one, as can be seen when American travelers are denied travel to Cuba by the government. 

interest in upholding this law is substantial, there should be some means of enforcing it in order to accomplish the objective which it was designed to meet. The best way of meeting this problem would be to add a provision to the statute itself, similar to provisions found in implied consent-drunk driving statutes, that all air passengers are subject to search for weapons before boarding. This should be upheld on the basis of a compelling governmental interest in national security and the safety of its citizens. Also, a new rule should be formulated, analogous to the state and military secrets provision, to allow the type of in camera testimony which Lopes employed. The rationales for the present exceptions for exclusion are not close enough to be applicable to hijacking cases, but could serve as precedent for formulation of a new rationale based on requirements of public safety. The situation might best be dealt with by enactment of a statute requiring non-disclosure of profile information. Since the danger is so great and the usefulness of the system would be destroyed if its contents were revealed, such a rule should be upheld.

In both the exclusion from the courtroom and the implied consent to be searched, the only legitimate governmental interest in the use of the anti-hijacking system relates to searches for weapons carried by potential hijackers. It is the general position of the law that when a search for a particular object is legitimate, any other evidence of a crime discovered in the process of a reasonable search is admissible at trial. However, the circumstances of anti-hijacking searches are unusual. In these cases there is no probable or reasonable cause to search other than a system of questionable reliability. A significant problem of the anti-hijacking system is its lack of selectivity; it tends to select law violators in general and not just hijackers. There are many possibilities for abuse of this system and, as Lopes indicates, it is not always possible to tell when the system is changed or abused.

Even if the contents of the profile were known, it would be difficult for the defendant and the public to be certain that the proper procedure had been followed in applying it. It is only because of the great counter-balancing danger from armed hijackers that such a system could be upheld. Therefore the unusual circumstances justify a different approach to the law.

In order to protect the public and yet also avoid the chances for mistake, discrimination, and abuse of the system, it should be the rule that any evidence of illegal activity other than weapons will not be admissible in court. Under this rule there will be no incentive for the government, or for prejudiced or overzealous airline employees, to try to catch other violators, for which there is not constitutional justification in such a situation; but the air traveling public will still have the protection of the system against the only danger that it is concerned with—potential hijackings.


[12] In United States v. Epperson, 454 F.2d 769, 771 (4th Cir. 1972), the court said: We think the search for the sole purpose of discovering weapons and preventing air piracy, and not for the purpose of discovering weapons and pre-criminal events, fully justified the minimal invasion of personal privacy by [the] magnetometer.

[13] If entry upon the premises be authorized and the search which follows be valid, there is nothing in the Fourth Amendment which inhibits the seizure by law-enforcement agents of government property the possession of which is a crime, even though the officers are not aware that such property is on the premises when the search is initiated. Harris v. United States, 331 U.S. 145, 155 (1947), overruled on other grounds, Chimel v. California, 395 U.S. 752 (1969). See LaFave, “Street Encounters” and the Constitution: Terry, Sibron, Peters and Beyond, 61 Mich. L. Rev. 40 (1963) Cf. Sibron v. New York, 392 U.S. 40 (1968).


[16] It appears from the opinion that the court could not tell whether the airline personnel were operating under the government-approved profile or under the “updated” profile issued by an airline employee. Noting that neither the government nor Pan American could assure the court that the airline employees at the boarding gate had not read the employee’s memorandum, the court concluded:

Under the circumstances, the Court must assume that the “updated” profile was, in fact, employed in selecting the defendant. 328 F. Supp. at 1101. Based on this information it appears that the defendant could have fit the original profile, as well as the revised one.
CRIMINAL LIABILITY UNDER THE REFUSE ACT OF 1899 AND THE REFUSE ACT PERMIT PROGRAM

The Refuse Act of 1899 imposes criminal liability for the discharge of refuse into any navigable water if the discharge is not sanctioned by a permit granted by the Secretary of the Army. Executive Order 11,574 establishes a program in which the Secretary of the Army, in conjunction with the Environmental Protection Agency issues permits for industrial discharges into navigable waters under Section 407 of the Refuse Act. The purpose of this permit program is to incorporate the Refuse Act into more recently enacted Federal water quality legislation, specifically the Federal Water Pollution Control Act. This comment will examine the imposition of criminal liability for water pollution under the Refuse Act of 1899, the Federal Water Pollution Control Act (FWPCA), and the Refuse Act Permit Program.

CRIMINAL LIABILITY UNDER THE REFUSE ACT OF 1899

The Refuse Act consists of sections 407, 411 and 413 of the Rivers and Harbors Act of 1899, Section 407 of the Act prohibits both discharging refuse matter into any navigable water or tributary of a navigable water or depositing material on the bank of any navigable water where it can be washed into the water. Two exceptions to the blanket prohibitory of any navigable water from which the same shall float or be washed into such navigable water ... provided ... that the Secretary of the Army, whenever in the judgment of the Chief of Engineers anchorage and navigation will not be injured thereby, may permit the deposit of any material above mentioned in navigable waters, within limits to be defined and under conditions to be prescribed by him, provided application is made to him prior to depositing such material . . .

The Refuse Act of 1899 makes it unlawful: [T]o throw, discharge, or deposit . . . either from or out of any ship, barge or other floating craft of any kind, or from the shore, wharf, manufacturing establishment, or mill of any kind, any refuse matter of any kind or description whatever other than that flowing from streets and sewers and passing therefrom in a liquid state, into any navigable water of the United States, or into any tributary of any navigable water from which the same shall float or be washed into such navigable water ... provided . . . that the Secretary of the Army, whenever in the judgment of the Chief of Engineers anchorage and navigation will not be injured thereby, may permit the deposit of any material above mentioned in navigable waters, within limits to be defined and under conditions to be prescribed by him, provided application is made to him prior to depositing such material . . .

Section 411 of the Refuse Act fixes penalties for violations of Section 407 by a fine of $500 to $2,500 or imprisonment for 30 days to a year. This section also provides that the court order the payment of one-half of the fine levied to any person giving information leading to a conviction under Section 407. Section 413 places upon the Department of Justice the duty to "vigorously prosecute all offenders" at the request of Army or other designated officials.

Despite a limited legislative history which indicates that the Congress did not consider the Refuse Act to be anti-pollution legislation, courts...
have consistently held that the discharge of industrial waste without a permit is a criminal offense under Section 407 of the Refuse Act regardless of the intent or knowledge of the discharger.12 In United States v. Republic Steel Corporation,13 the Supreme Court recognized that the purpose behind the Act was not only to prohibit discharges causing impediments to navigation but also to outlaw the discharge of all refuse matter. The Court stated that the Refuse Act must be read “charitably” in order to serve the purpose of protecting the nation’s water resources.14 In United States v.

6 of the 1890 Rivers and Harbors Act, 27 Stat. 453, and the 1894 Rivers and Harbors Act, 28 Stat. 363. Both the language and the legislative history of those Acts indicate that they were intended to prohibit only those discharges which physically impared the navigability of waters. See 21 CONG. REC. 1318 (1890); 26 CONG. REC. 4348 (1894); 21 OP. ATT’Y. GEN. 305 (1896). The 1899 Rivers and Harbors Act was passed in response to both a direction in the 1896 Rivers and Harbors Act that all general laws for the preservation of navigable waters be compiled and the Supreme Court’s decision that the Federal government had no common law authority over navigable waters in Willamette Iron Bridge Co. v. Hatch, 125 U.S. 1 (1888). At the time of its enactment, the Army Corps of Engineers (the formulators of the 1899 compilation of the 1890 and 1894 Acts), the bill’s sponsor in the Senate, and the House Conference Report on the Act, all stated that the 1899 Act contained no essential changes in the 1896 Act to cover pollution that did not obstruct or constitute a separate offense. See Druley, The Refuse Act of 1899, 3 BNA ENVIRON. REP., MONO. 11 (1972) 28 [hereinafter cited as Druley]; Hearings on Water Pollution Control Legislation on Oversight of Existing Program Before the House Comm. on Public Works, 92d Cong., 1st Sess., pt. 1, at 262, 288, 305–6 (1971) [hereinafter cited as 1971 House Hearings].


13 362 U.S. 482 (1960). The discharge of inorganic solids into the Calumet River violated Section 407 of the Refuse Act in that it both created an obstruction to navigation and constituted refuse. The Court rejected a narrow reading of the Act in order to best serve the purposes of protecting the nation’s waterways.

14 The Court stated, id. at 491:

We read the 1899 Act charitably in light of the purpose to be served. The philosophy of the statement of Mr. Justice Holmes in New Jersey v. New York, 283 U.S. 336, 342, that “a river is more than an amenity, it is a treasure,” forbids a narrow cramped reading. . . .

Standard Oil Company,15 the Court broadly defined refuse matter as “anything which has become waste including foreign substances and pollutants.”16 Consequently, discharges of commercially valuable oil,17 organic settleable solids,18 cyanides, phenols, sulfides, and ammonia,19 and heated water20 have been held to violate Section 407 of the Act. Thus the Refuse Act as interpreted by the courts establishes a simple standard: discharge of anything into navigable water without a permit constitutes a Federal criminal offense.

Violations of Section 407 of the Refuse Act are punishable by fines and imprisonment.21 Each act of discharging refuse constitutes a separate violation of the Act.22 Although no decision supports the idea directly, it is generally believed that each day of a continuous discharge constitutes a separate violation.23 In two instances, the court in the Southern District of New York has imposed cumulative fines for continuous discharges. In United States v. Standard Brands, Inc.,24 the court decided that the use of multiple counts was the only means of distinguishing long-term, continuous dischargers from occasional polluters and assessed a fine of $125,000 for violations which occurred over a two year period. The same court later fined another violator $200,000.25 These two assessments represent the largest fines levied under the Refuse Act.

In addition to criminal fines, the Act provides for the imprisonment of individuals responsible for the violation.26 In the past, courts have been re-
luctant to hold corporate officials personally liable and either fine or jail them for the Refuse Act violations caused by their corporations. Recently the president of a corporation was fined $1500 and three other individuals have been indicted in separate instances for the Refuse Act violations of their companies.27

While criminal sanctions have on occasion been utilized in the enforcement of anti-trust laws,28 rent and housing controls,29 and local housing code ordinances,30 the imposition of criminal liability under the Refuse Act is a new aspect to the enforcement of water pollution control legislation. As in all criminal prosecution, the purpose of imposing criminal sanctions is to deter the potential violator by threatening him with the public stigma of criminal prosecution and the imposition of criminal penalties.31 In general, the imposition of criminal

27 On October 27, 1971, J. J. O’Donnell, President of Woolens, Inc., of South Grafton, Massachusetts, became the first individual to be fined for his company’s violation of the Refuse Act when a Massachusetts District Court fined both him and the corporation the maximum amount. N.Y. Times, Nov. 5, 1971, at 1, col. 6; 1 BNA ENVIRON. REP. 850, CURRENT DEVTS. (1971). At present, the head of a Baltimore car wash, the president of a ceramics concern, and the manager of United States Steel Corporation’s South Works in Chicago are under indictment for aiding and abetting illegal discharge into navigable waters. James P. Byrne, President of Baltimore Imported Car Service and Storage, Inc., was indicted on 100 counts of pumping solvents and petroleum residue into a tributary of Chesapeake Bay. Edward L. Bauman, head of Bettigter Corporation, was indicted on 5 counts of dumping clay-like sludge into the Charles River in Massachusetts. Charles M. Kay, U.S. Steel South Works, faces charges stemming from the discharge of iron oxides and solid waste into Lake Michigan. N.Y. Times, Nov. 5, 1971, at 1, col. 6; N.Y. Times, Nov. 14, 1971, at 3, col. 2. United States v. U.S. Steel Corp., 3 BNA ENVIRON. REP. 1037 (N.D. Ill. 1971).


29 See Ball, Social Structure and Rent Control Violations, 65 AM. J. SOCIOLOGY 598 (1968).


31 Ball & Friedman, The Use of Criminal Sanctions in the Enforcement of Economic Legislation: A Socio-

liability place a moral stigma on the act proscribed and serves to warn and deter further transgressions by its penalties.32 The Refuse Act attaches the stigma of criminality to pollution and establishes sanctions to deter it.

There is evidence to suggest that the practical deterrent value of enforcing water pollution laws like other economic regulations33 with criminal penalties alone, is minimal. In the case of the Refuse Act, nearly every industry in the country is presently in violation of the Act.34 Consequently there is no great public stigma attached to violating the Act.35 Pollution has, until recently, been viewed as morally neutral, if not blameless by society in general.36 Further, the maximum fine possible under the Refuse Act is far less than the cost of installing necessary abatement facilities and altering a plant’s production system to eliminate effluent discharges.37 The threat of individual responsibility including fines and jail sentences is diluted by the practical difficulties of proof of individual liability within the corporate structure.38 Neither
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the moral stigma of being branded a criminal violator of the Refuse Act nor the actual penalties imposed have much deterrent value.\(^{39}\)

The Supreme Court, in *Wyandotte Transportation Co. v. United States*,\(^{40}\) recognized that the criminal penalties of the Refuse Act alone may provide insufficient deterrence and held that injunctive relief is both appropriate and necessary to insure the full effectiveness of the statute. So interpreted, the Refuse Act empowers the court to order the clean-up of past discharges\(^{41}\) and the immediate cessation of all present and future violations.\(^{42}\) This injunctive power allows the court to deal with major industrial polluters by depriving the violator of the economic advantage of his business until his compliance is obtained.\(^{43}\)

While the anti-trust cases and Housing Code experiences indicate that the criminal penalties of the Refuse Act may be too insignificant to provide more than a modest degree of deterrence, the Act does attach the stigma of criminality to behavior once generally considered a right of industry. Most important, the Refuse Act provides the legal basis for the comprehensive, immediate abatement of all water pollution from industrial sources through injunctive relief. The existence of the right to injunctive relief under the Act prevents the dismissal of Refuse Act penalties as trivial.

Despite repeated court rulings\(^{44}\) and a statutory pronouncement that the Refuse Act is not im-

\(^{39}\) The enforcement of Housing Code violations with criminal penalties in New York City suggests that the combination of insignificant fines, the remote possibility of individual liability, and the seeming moral neutrality of an economic regulation like Housing Codes leads to a trivialization of the offense by the courts thus nullifying the deterrent value of criminal sanctions. Of 40,000 yearly prosecutions the average fine was less than $13. The average fine per count or per code violation was less than one dollar. Grad, *Implications at 7-23.*

\(^{40}\) 389 U.S. 191 (1967).

\(^{41}\) *Id.*


paired or superseded by subsequent water pollution control legislation\(^{45}\) and the demonstrated effectiveness of the Act in controlling pollution,\(^{46}\) the Justice Department has not consistently enforced the Act against continuous dischargers. The Department has used the Act only in cases of infrequent occurrence like oil spills or as a last resort when other state and Federal procedures have failed.\(^{47}\) The policy of the Justice Department has been to defer action under the Refuse Act, proceeding instead under the more recently enacted Federal Water Pollution Control Act.\(^{48}\)

THE FEDERAL WATER POLLUTION CONTROL ACT

The Federal Water Pollution Control Act (FWPCA)\(^{49}\) establishes an alternative legislative scheme to control water pollution. Unlike the Refuse Act, the Federal Water Pollution Control Act does not impose criminal liability but rather operates through the civil enforcement of state-created water quality standards. The Federal Water Quality Act of 1965,\(^{50}\) an amendment to the Federal Water Pollution Control Act, requires the creation of water quality standards by the states subject to approval by the administrator of the Environmental Protection Agency (EPA).\(^{51}\) In formulating standards, the states were required to enhance the quality of water while taking into account the projected use of the waterway.\(^{52}\) To

\(^{45}\) The Federal Water Pollution Control Act explicitly rejects the contention that it has superseded the Refuse Act. The FWPCA, at 33 U.S.C. § 1174 (1970) provides: This chapter shall not be construed as ... affecting or impairing the provisions of sections 407, 408, 409, and 411 to 413 of this title [the provisions of the Refuse Act]. ...\n


\(^{48}\) See Druley at 5-8.


\(^{52}\) 33 U.S.C. § 1160(c) (3) (1970). Specified water uses include "public water supplies, propagation of fish and wildlife, recreational purposes, agricultural, industrial and other legitimate uses." The strictness of the criteria established depends on the projected use.
date, all fifty states have established water quality standards and have accompanying implementation plans but only 27 have been completely approved by the EPA Administrator.\footnote{53}

The discharge of any substance which reduces the quality of the waters below the state water quality standards governing that waterway constitutes a violation and is subject to FWPCA enforcement proceedings.\footnote{54} The FWPCA enforcement procedure begins with a conference between federal and state agencies concerning a possible violation.\footnote{55} Based on the results of the conference, the EPA can then recommend that the state agency take action designed to secure abatement of the violation. The state has at least six months to respond.\footnote{56} If the state fails to act, the Administrator of the Environmental Protection Agency must call a public hearing at which all parties are entitled to testify. The Federal Hearing Board must make factual findings and recommend that the Administrator of the Environmental Protection Agency take appropriate action to secure abatement.\footnote{57} The Administrator then sends the findings of the Hearing Board to the offending person or company together with a notice specifying a reasonable time of not less than six months in which to comply.\footnote{58}

If the violator still refuses to comply with the Hearing Board’s recommendations, the Administrator may request that the Attorney General bring suit to secure abatement where the discharge has an inter-state impact.\footnote{59} At least 180 days must elapse between the Administrator’s initial notification to the violator and a request for the Attorney General to begin court action.\footnote{60} When the case is finally litigated, the court has wide discretion. It reviews the factual question of whether the defendant discharged in violation of applicable standards and it considers the “practicality and physical and economic feasibility of complying with such standards.”\footnote{61} The court can refuse to enforce an EPA abatement order if it decides that the cost of compliance to the company is too great.

Thus there exists two different legislatively created standards regulating water pollution. Under the Refuse Act, any discharge without a permit is a criminal offense subject to immediate Federal prosecution. However, the FWPCA-state standards specify that only discharges of certain substances at levels greater than the standards allowed are violations. These violations are subject to drawn-out proceedings and only a remote chance of judicial enforcement.\footnote{62}

**The Refuse Act Permit Program**

The existence of two standards creates a dilemma for dischargers.\footnote{63} Since the Refuse Act is not superseded by FWPCA legislation,\footnote{64} an industry may be officially in compliance with FWPCA water quality standards and still be liable for criminal prosecution under the Refuse Act. Further, an industry desiring to comply with the Refuse Act was unable to secure a permit before President Nixon created the Refuse Act Permit Program on December 23, 1970 since no procedure existed for their issuance.\footnote{65} The Executive Order seeks to resolve the conflict between the two standards by making the issuance of a Refuse Act permit contingent upon compliance with FWPCA water quality standards.\footnote{66} Thus if a discharger meets FWPCA standards, he will be granted a permit and will have satisfied both statutory requirements and be exempt from all criminal liability.

According to the Executive Order, the Secretary of the Army is responsible for granting or denying permit applications.\footnote{67} The Secretary must base his decision on four factors: (1) compliance with

\footnote{53} As of June 17, 1971, twenty states and five territories had fully approved water quality standards. The standards of three states were pending EPA approval and twenty other proposed standards were under negotiation with no substantive problems reported. \textit{1971 House Hearings}, at 554.


\footnote{58} \textit{Id.}

\footnote{59} 33 U.S.C. § 1160(g) (1) (1970). If an intra-state discharge endangers the health and welfare of individuals within a state, the EPA must secure the written consent of the Governor of the state in which the discharge occurs before requesting the Attorney General to sue.

\footnote{60} 33 U.S.C. § 1160(c) (5) (1970).

\footnote{61} \textit{Id.}

\footnote{62} The remoteness of court action is emphasized by the fact that as of 1970, only one court proceeding had been instituted under the FWPCA for violation of water quality standards. \textit{3 Nat. Res. L.J.}, 41, 46 (1970).

\footnote{63} The existence of the two standards had been held not to create a situation which is unconstitutionally vague. \textit{United States v. United States Steel Corp.}, 328 F.Supp. 354 (N.D. Ind. 1970).

\footnote{64} \textit{See} notes 44-45 supra.

\footnote{65} Exec. Order No. 11,574, 3 C.F.R. 188 (1970).

\footnote{66} Section 21(b) (1) of the Water Quality Improvement Act of 1970, an amendment to the FWPCA, requires that applicants for federal permits obtain certification by state water pollution control agencies that there is reasonable assurance that state water quality standards will not be violated. 33 U.S.C. § 1171(b) (1) (1970).

\footnote{67} Exec. Order No. 11,574, § 2(a) (2), 3 C.F.R. 188 (1970).
appropriate water quality standards; the effects on fish and wildlife not reflected in water quality considerations; environmental considerations required by the National Environmental Policy Act of 1969; and additional factors prescribed by the Refuse Act or other pertinent laws.

With regard to judging compliance with applicable water quality standards and related considerations, the Order directs that the Secretary of the Army shall accept the findings of the Administrator of the EPA. The Order further directs that if a state agency denies the certification required by Section 21(b) of the FWPCA, the permit application must be denied. In that case, the EPA must recommend denial and the Secretary must accept this recommendation. If the state agency certifies that the proposed discharge will not violate water quality standards, the position of the EPA, as well as the Army Corps of Engineers is to give considerable, although not conclusive, weight to that finding. The EPA recognizes that both the Executive Order and the FWPCA place primary responsibility for preventing and controlling water pollution on the states. Hence the EPA will not likely override a state certification unless it is clear that the proposed discharge will fail to meet water quality standards or would be inconsistent with the EPA's interpretation of the standards.

In cases where state certification has been obtained, but the EPA determines that the discharge may violate applicable standards, the EPA could recommend that the Army Corps of Engineers deny the Permit. Rather than do this the EPA indicates it will recommend issuance of a permit which imposes specific duties on the discharger. The applicant may be issued a permit which requires him to adhere to a timetable for the construction of abatement facilities necessary to ensure compliance with the water quality standards. Serious default in meeting the conditions specified would constitute grounds for revocation of the permit and possible prosecution under the Refuse Act by the Attorney General.

Consequently, the first and most important consideration required by the Executive Order, compliance with applicable water quality standards, is determined largely by reference to state established standards and state certification that these standards will not be violated. The EPA's position seems to be that it will accept state findings of water quality considerations unless it finds a gross deviation. In such cases, EPA will frequently issue a conditional or restrictive permit.

The second requirement of Executive Order 11,574 directs that the Secretary of the Army consult with the Secretary of the Interior, the Secretary of Commerce, and the Administrator of the EPA regarding the effect on fish and wildlife. The timing of water quality considerations unless it finds a gross deviation. In such cases, EPA will frequently issue a conditional or restrictive permit.

Failure to meet final completion date or serious overrun of an interim date will constitute grounds for denial of a permit, until construction is completed. If the specified treatment subsequently proves insufficient to meet FWPCA water quality standards, EPA reserves the right to require higher degrees of treatment.
life of a proposed discharge. If, as a result of this consultation, the Secretary finds that a proposed discharge will unreasonably affect fish and wildlife, he may deny a permit even though the state has certified and the EPA has recommended a permit be issued. However, this consideration applies only to permits which propose to deepen, divert, or physically alter the stream or body of water. For discharges which do not physically alter the water body, the Secretary has no discretion to deny a permit on the grounds of adverse effect to fish and wildlife.

The Executive Order further directs that the Secretary perform such consultations as required by the National Environmental Policy Act of 1969 (NEPA). NEPA requires that to the fullest extent possible, the policies, regulations, and laws of the United States shall be interpreted and administered in accordance with the policies it sets forth. Foremost of these policies is the coordination of all federal programs to obtain the widest range of beneficial uses of the environment “without degradation” in a manner so as to “enhance the quality of renewable resources.” To insure that these policies are properly considered, the NEPA requires that all federal agencies submit to the Council on Environmental Quality a detailed statement on the environmental impact of any proposed action, including possible alternative procedures. Thus the Army Corps of Engineers is required to submit the environmental impact statement to the Council before it can issue any discharge permits. However, Army Corps of Engineers regulations administering the permit program do not require submission of NEPA statements as part of a Refuse Act permit application.

Because of this failure to comply with NEPA requirements, the Army Corps has been enjoined from issuing permits pending alteration of its regulations to require submission of the environmental impact statement. When amended, Army Corps regulations should establish failure to comply with the NEPA standard of non-degradation as another ground for denying a permit. At present, the regulations de-emphasize this consideration in deciding whether to issue a permit.

Finally, the Secretary of the Army must consider “factors, other than water quality” which are prescribed by the Refuse Act. Army Corps of Engineers regulations limit this consideration to analysis of the impact a discharge may have on anchorage or navigation. Any discharge, which in the opinion of the Secretary will impair navigation or anchorage, can be denied a permit regardless of compliance with water quality standards and other considerations. Thus the Secretary of the Army has the authority to unilaterally deny a permit only if the refuse discharged will block or otherwise impair the navigability of the waterway. Since most industrial effluents do not meet these criteria, the Army Corps of Engineers is required to submit an environmental impact statement as part of a Refuse Act permit application.

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not physically impair the waterway, the Secretary has little power to deny a permit on the grounds that the discharge will pollute the water.

In short, the decision to grant a Refuse Act permit is made in three stages. First, the appropriate state agency considers the proposed discharge and existing abatement facilities to determine if the applicant is in compliance with state water quality standards. If the state agency certifies the application, the EPA then considers it in light of the state agency comments and the applicable state water quality standards. In the event that the EPA believes the discharge will violate state water quality standards, it may deny the application or condition the permit on further improvements. Once the EPA has decided that water quality considerations are sufficiently met, it recommends that the Secretary of the Army grant a permit. At this point, the Secretary of the Army can deny a permit only if he finds the discharge will threaten fish and wildlife or will impair navigation or anchorage. The most heavily weighted factor is compliance with water quality standards. This determination is made at the state level subject to review by the EPA. The Army Corps of Engineers and the general public provide only advisory assistance. 99

Since all discharges to navigable waters are unlawful until authorized by an Army Corps of Engineers permit, an industry which does not apply for a permit or which fails to receive a permit, is liable for criminal prosecution under the Refuse Act. 91 Should an industry secure a permit and proceed to violate any condition of that permit, the Attorney General may move to impose any of the penalties of the Refuse Act. For instance, an industry may be granted a permit which specifies that the company must construct certain abatement facilities according to a designated construction plan which includes specified interim completion dates. 92 In addition, the permit may provide that the industry's discharge must at no time exceed the limits set by the state water quality standards. If the company substantially overruns a construction date, it becomes liable for criminal prosecution under the Refuse Act for violating the conditions of its permit, even though at no time did its discharge exceed the limits prescribed by the standards. 93 If the company successfully completes the required installations, but its discharge violates the applicable standards, potential Refuse Act liability—fines, imprisonment, and injunctive relief—also attaches.

**THE EFFECTS OF IMPOSING CRIMINAL LIABILITY UNDER THE REFUSE ACT PERMIT PROGRAM**

In sum, the Refuse Act of 1899 imposes strict criminal liability for discharges to navigable waterways. Discharges made in accordance with the conditions of a Permit granted by the Refuse Act Permit Program cannot result in criminal prosecution. Although the Executive Order directs that other factors be considered, the primary factor controlling the issuance of a permit is the applicant's compliance with state created water quality standards. 94 A discharger in compliance with applicable water quality standards, will likely be granted a permit and be absolved of criminal liability, whereas a discharger not in compliance with the water quality standards will probably be denied a permit and will be liable for the sanc-

99 Army Corps of Engineers Regulations, 333 C.F.R. 209.131 et seq. (1971), require that public notice of proposed discharges be made when the completed application is furnished to representatives of EPA and other federal agencies. Id. at (j)(i). This notice must describe the proposed discharge and provide interested parties any information they may need to evaluate its likely impact. Members of the public then have 30 days to express their views on the application. Id. at (j)(i), and (j) (v). All information submitted on permit applications is open to public inspection at the District Engineer Office unless the applicant can demonstrate that the information contains a trade secret. Id. at (j)(i). Comments received by the Corps of Engineers will be used in deciding whether a permit will issue, after the applicant has had any opportunity to rebut the objections. Id. at (j)(i), (j) (v).

Depending on the degree of interest expressed by the public in response to public notice, the District Engineer may in his discretion call a public hearing on the application. Id. (k) (1). In cases where a proposed discharge is challenged on the grounds that it fails to meet water quality standards, the Army Corps of Engineers District Engineer and EPA Regional Representative shall be present at the hearing. Id. (k) (2). The hearing allows an "open and full discussion" by any interested parties on all issues involved in issuing a permit to the applicant. Id. (k) (4). The purpose of the hearing is largely informative and there is no indication that the Army Corps of Engineers or the EPA must be bound by its conclusions.

91 Filing of an application for a Refuse Act Permit does not preclude the institution of criminal proceedings for discharges made before or during the processing of the application. 333 C.F.R. 209.131 (d) (4) (1971). As of December 7, 1971, nearly 6 months after the July 1 deadline for filing permit applications, the Army Corps of Engineers had received 19,715 applications for 34,873 outfalls. 232 of these applications were determined by the Corps to be complete and 17 permits had been issued. It was estimated that these applications alone would take two to four years to process. Druley at 5.

92 1971 EPA Policy Statement, X.

93 Id.

94 See text accompanying notes 63—89 supra.
tions of the Refuse Act. Thus the Refuse Act Permit Program imposes the criminal penalties of the Refuse Act by reference to the FWPCA-state created water quality standards.

The effect of issuing Refuse Act permits based on compliance with existing water quality standards is to impose the criminal liability of the Refuse Act without reference to the actual harm done to the waterway by a particular discharge. Water quality standards measure the concentration of a particular pollutant in the water. They do not measure or limit the quantity of effluent a particular industry is discharging into the water. According to the water quality standard approach, any discharge with a concentration greater than the specified level constitutes a violation. For instance, Illinois and Indiana prohibit the discharge into intrastate waters of any effluent with a cyanide concentration of greater than 0.025 milligrams per liter. Discharge of concentrations above this level constitutes grounds for denial of a Refuse Act Permit and subsequent criminal liability under the Refuse Act. The concentration of a particular effluent, however, does not reveal the quantity of pollutants discharged daily. It is this measurement, the quantity of pollutants added, rather than their concentration, that determines the impact the effluent will have on water quality.

In determining the quantity of waste discharged, the volume of the discharge or the flow is a crucial factor. The greater the volume of effluent discharged at a given concentration, the greater the amount of pollutants put forth. Large flow volumes with low pollutant concentrations mean a large poundage of effluent is entering the water. Small flows with high concentration of individual pollutants mean low effluent poundage is being discharged. The conversion of discharges measured in milligrams per liter to pounds per day takes into account the volume of flow and provides a realistic measurement of how much polluting material enters the waterway.

To illustrate this point, assume two industries are located next to each other on the Grand Calumet River in Indiana. Company A is a large steel mill discharging ninety three million gallons of effluent daily from seven outfalls. The concentration of a pollutant in effluent from plant A is 9 mg/l. Plant B is a small manufacturing firm. Its industrial effluent is completely recycled. Only waste from its sanitary system is discharged to the river. Company B employs 3 men and discharges 3,000 gallons per day. The concentration of this pollutant is consistently 10 mg/l. Assume also that the applicable Indiana standard provides that permissible concentrations of this pollutant must be less than 10 mg/l. Thus company B is in violation of the water quality standard and its Refuse Act permit should be denied, while company A is in full compliance. Company B will then be liable for prosecution under the Refuse Act because it discharges without a permit.

When the concentration measurements are converted into pounds per day, company B discharges only one-fourth of one pound of the pollutant each day. Company A on the other hand can legally discharge 6,975 pounds of the same effluent. Clearly company A poses a greater threat to the waterway. Yet it is company B that will be denied the permit, and will be subject to criminal fines and imprisonment. Thus the water quality standard approach

Although a hypothetical value, 93 million gallons per day is not an unrealistic discharge for a steel mill since the production of one ton of steel generally requires between 20,000 and 40,000 gallons of water. For discussion of various water uses in the steel industry, see Kermer, Pollution Control in the Steel Industry, INDUSTRIAL POLLUTION CONTROL HANDBOOK 10-3 (Lund ed. 1971).

IND. ADM. RULES and REG. 68-523 (8) SPC-8. Water quality criteria for the Grand Calumet River sets 10 mg/l as the limit for BOD, a measure of organic waste present in industrial effluent.

The precise calculations for the conversion are:

Company A's pollutant concentration =
9 mg/l × 93,000,000 (gallons per day total effluent) = 120,000 (constant)

A's waste load in pounds per day = 6,975

Company B's pollutant concentration =
10 mg/l × 3,000 (gallons per day total effluent) = 120,000 (constant)

B's waste load in pounds per day = 0.25

See note 98 supra.
of the FWPCA, in addition to having questionable practical utility as a means of regulating water pollution,\textsuperscript{104} diverts the imposition of criminal liability under the Refuse Act from its intended purpose of protecting the nation’s waterways from further degradation.

\textbf{One Alternative to Present Water Pollution Control Legislation}

On November 2, 1971, the Senate unanimously passed an amendment to the Federal Water Pollution Control Act which might provide a legislative solution to the present series of programs.\textsuperscript{105} The Senate enactment establishes a policy designed to eliminate the discharge of all pollutants into navigable waters by 1985, with several interim target dates.\textsuperscript{106} The proposal repeals the existing

\textsuperscript{104} There is evidence that many water quality standards adopted by the states and accepted by the Environmental Protection Agency are deficient. In almost every instance, the standards were formulated without sufficient scientific knowledge of a safe level of pollutants. This lack of knowledge is especially true in the case of metals and other toxic substances. See President’s Council on Environmental Quality, Toxic Substances iv (1971); Zuzik, \textit{Research Programs for Air and Water Pollution Control}, \textit{Industrial Pollution Control Handbook} 9-1, 9-16 (Lund ed. 1971); Louria, \textit{The Human Toxicity of Certain Trace Elements}, \textit{76 Annals of Internal Medicine} 307 (1972).

Furthermore, because no baseline of existing water quality had been defined when the standards were formulated, many standards set discharge limits above the pollutant concentrations presently in the water, thus allowing legalized deterioration of bodies of water such as the Great Lakes. Francis Mayo, Regional Administrator of the EPA, statement to the Illinois Pollution Control Board, August 19, 1970. This result directly contradicts the guidelines established by the Department of the Interior, to which all state standards must be submitted for approval, which expressly stated that in no case would standards providing for less than existing water quality be acceptable. U.S. Department of the Interior, Guidelines for Establishing Water Quality Standards for Interstate Waters 4-5 (1966).\textsuperscript{107} When EPA finds a violation of the standards discussed above, it must notify the violator and the appropriate state agency. If the state takes no action in 30 days, EPA can assume enforcement and issue an abatement order requiring immediate compliance or in the alternative bring a civil suit against the violator. EPA can obtain temporary and permanent injunctive relief for violation of an abatement order. \textit{Id.} \textsection 309 (a) (1), (b).

\textsuperscript{105} See also William Ruckelshaus, Administrator of the EPA, the ‘‘best technology standard’’ requires closed-cycle recirculation and recovery of most industrial wastes which would otherwise be discharged as effluent. The scientific know-how to construct and install abatement facilities meeting this standard does exist. The problem is one of economic feasibility. See 1971 Senate Hearings at 96.

\textsuperscript{106} To

\textbf{FWPCA enforcement procedure with its 180 day delay and allows the EPA to issue an abatement order or seek injunctive relief 30 days after the violation is reported.\textsuperscript{107} The state-created water quality standards are eliminated. Rather, dischargers must install abatement facilities that meet a ‘‘best available technology’’ standard and must totally eliminate all effluent discharges by the 1985 deadline.\textsuperscript{108} Under the proposal, the Refuse Act Permit Program would be transferred from the Army Corps of Engineers to the Environmental Protection Agency.\textsuperscript{109} Refuse Act permits would be issued only if the discharger has installed the best available abatement facilities and is progressing adequately toward the cessation of all discharges.\textsuperscript{110} Penalties for willfully or negligently violating an abatement order or violating a Refuse Act permit condition include a fine of not more than $25,000 and not less than $2,500 per day and up to one year in jail.\textsuperscript{111}

This proposal would allow the Federal Government to proceed with only minimum delay against a violator to secure penalties which while not labeled as criminal sanctions, provide more meaningful deterrence than the maximum fines permitted under the Refuse Act.

\textbf{Conclusion}

Experience with the enforcement of other economic regulations suggests that the relatively minor criminal penalties imposed by the Refuse Act provide little deterrence against an activity

\textbf{1971 Senate Hearings at 96.}