



MANAGING THE EIA PROCESS

ASSESSING THE IMPACT OF ENVIRONMENTAL IMPACT STATEMENTS ON CITIZENS

William C. Sullivan

Frances E. Kuo

Mona Prabhu

University of Illinois at Urbana-Champaign

While it is no secret that environmental impact statements (EISs) are often difficult for citizens to read and comprehend, no research has examined the actual understanding citizens gain from reading an EIS. We presented the project description portion of an EIS for flood control measures on the Hickory Creek in Joliet, Illinois to 113 Joliet citizens who read the materials and answered a number of questions about the proposed project and its environmental effects. Citizens' understanding of the EIS material was atrocious; on two measures of understanding, 70% of the participants answered correctly at a level no better than chance (blind guessing). Although understanding was significantly correlated with reading ability, even the best readers understood at a level that was far from adequate. Public agencies should examine how well citizens understand the EIS documents they produce. We suggest the techniques and procedures described here may be a fruitful way of conducting such tests.

After working diligently for months on an environmental impact statement (EIS), a working group within a federal agency produced a document that fit the letter—and spirit—of the National Environmental Policy Act (NEPA). During the initial scoping process, local citizens were

Address requests for reprints to: William C. Sullivan, Human-Environment Research Laboratory, Department of Natural Resources and Environmental Sciences, University of Illinois at Urbana-Champaign, 1103 S. Dornier Drive, Urbana, IL 61801.

invited to read the draft analysis and comment on the proposed project. Although a small group participated in a public meeting, it seemed no one had actually read the EIS materials. It wasn't until the local newspaper began a series of stories about the proposed project that people got interested—and in this case, alarmed. The problem was the newspaper stories were not as accurate as the EIS, and some local people ended up very upset even though their concerns would have been addressed if only they had read the EIS.

Why is it that people so often refuse to read about a proposed project in an EIS only to complain loudly and vigorously when the same project is described in the local newspaper? Is it laziness, or is there something about the EIS documents that contribute to this pattern?

Perhaps it is because EISs are difficult to read. Weiss (1989) suggested, and Gallagher and Patrick-Riley (1989) showed, that EISs and federal land management plans are “written for people with 3 to 6 years of college education, far beyond the reading ability of the average person” (p. 85). In a similar line of reasoning, the court asserted in *Oregon Environmental Council v. Kunzman* (1985), that the most readable passages of the EIS in question far exceeded the estimated average reading skills of Oregon citizens. While these works have helped establish that EISs require an advanced reading level, we do not know the extent of public comprehension of EIS documents. Can citizens understand the important points in these documents despite their difficult text?

Although most people prefer reading several grade levels below their ability (Klare 1963), they will struggle with difficult text if they are motivated by some possible benefit (Diehl and Mikulecky 1981). Because no one has examined how well citizens actually understand EIS materials, we do not know if people are “plowing through” and understanding a great deal of the EIS, or if they understand just the basic facts, or if they are actually not understanding. We also do not know what portion of citizens are having difficulty understanding EIS materials, or what information in the EIS is not being communicated. This study begins to explore these issues.

Before we examine our approach to this work, it seems appropriate to ask why agency personnel might find it important that EISs are read and understood. In addition to the various political and philosophical reasons (for a brief review, see Sinclair and Diduck 1995), there are several compelling pragmatic reasons. On the most general level, an EIS that is understandable allows greater levels of citizen participation. Increased citizen participation, especially early in the process, generally means an agency has time to find ways to accommodate diverse views (Burchell et al. 1994), and in doing so, the agency builds credibility and good will (Jain et al. 1993).

Even before final documents are prepared and decisions are made, citizen participation in the EIS process provides excellent opportunities for dispute

resolution (Ketcham 1988). According to the U.S. Forest Service, participation by informed citizens “substantially reduces the number of subsequent appeals and law suits” (Ketcham 1988, quoted in Jain et al. 1993). Thus, these benefits—building agency credibility and public support, resolving disputes early, and reducing the number of appeals and law suits—result from EISs that citizens can read and understand.

When they do read an EIS, what are citizens learning from it? Can they recall the basic facts of the proposed project? Do they understand its essence; that is, do they grasp the gist of the proposal? Can they make inferences about the environmental effects of the project?

Although citizen participation need not require that citizens understand everything written in a particular EIS, some basic level of understanding seems necessary. But what is an adequate level of understanding? It seems reasonable to expect citizens to have the academic equivalent of a “C,” or at least 70% understanding, after reading an EIS. That is to say, citizens need not understand every detail described in the EIS, but the authors would hope that the majority of citizens understand the material at this basic level.

If the level of understanding is the academic equivalent of receiving a “C,” then concerns about understanding, although real, are not a high priority. If, on the other hand, the level of understanding is considerably lower—as the work by Gallagher and Patrick-Riley (1989) suggests it may be—then the problem is of far greater importance, and substantial attention should be devoted to producing EIS documents that citizens can better understand.

Another issue that requires attention concerns the number of citizens who fail to understand the EIS materials they read. If only 10% of citizens are unable to understand the essence of the proposed project, then this concern, although real, is not a major problem. If one-third, or one-half of the citizens reading an EIS have difficulty understanding, then the problem is of significant importance and deserves considerable attention.

To begin to explore these questions, we presented the project description portion of an EIS to a group of citizens who read the materials and then answered a number of questions about the proposed project and its environmental effects. In order to assess the proportion of citizens likely to have difficulty comprehending the EIS, we gave the EIS to a group of citizens whose reading abilities had been measured—students at two high schools in Joliet, Illinois.

Method

Participants

Bendix (1984) suggests that EISs be reviewed by teenagers before they are published. If the EIS material is understood by teenagers, given their read-

ing abilities and levels of experience, the vast majority of the general public should be able to understand the material. With this logic, high school students were recruited to participate in this study. Freshmen and junior students from two Illinois high schools, Joliet Central and Joliet West, participated in this study.

Because all freshmen at both high schools are required to take a composition course during their second semester, we randomly selected the freshmen participants ($n = 85$) from 12 sections of freshman composition. Juniors at both high schools are required to take U.S. history during the spring semester. We randomly selected the junior participants ($n = 28$) from six sections of U.S. history.

The two high schools gave us access to students' scores on the *Comprehensive Test of Basic Skills*, the standardized achievement test given to each student during their first year in high school. The test scores include a measure of each individual's reading ability expressed in national percentiles, that is, the percent of the U.S. population of high school students that a particular student reads better than.

Selecting an EIS

Three criteria were used to select a project and its EIS for this study. The project had to be real and not hypothetical; it had to cause physical and perceivable change in the landscape—change that citizens could see; and it had to be fairly new or ongoing—we did not want to select a project that had been completed.

An EIS prepared by the Illinois Department of Transportation for flood improvements on the Hickory Creek in Joliet, Illinois, met these criteria and was selected for this study. It included features of a typical EIS such as descriptions of the proposed action and its alternatives, and supporting graphic aids such as maps and diagrams.

There is evidence that the authors of this EIS took steps to make the document readable. Gallagher and Jacobson (1993) identified 10 typographic criteria that make EISs easier to read and understand. In their study, which assessed the typographic quality of 150 EISs, the average EIS met fewer than seven of the 10 criteria. The Hickory Creek EIS met six of these 10 criteria—it had a readable type size, included “ragged right” justification, used appropriate headings, had proper spacing between paragraphs and sections, and was reproduced in a clear and readable fashion. Moreover, this EIS did not suffer from typical typographic difficulties such as nonstandard page size. Thus, the typographic quality of the Hickory Creek EIS was not substantially worse than the average EIS.

Most EIS documents require an advanced reading ability. When Gallagher and Patrick-Riley (1989) examined 23 federal land management plans with the Flesch Reading Ease Scale (Flesch 1974), they found the

plans ranged from “very difficult” to “difficult.” “The easiest plans are written at the 15th-grade level (third year in college). The most difficult plans are written at the 17th-grade level (college graduate)” (Gallagher and Patrick-Riley 1989, p. 87). The EIS selected for this study was considerably easier to read. According to the Flesch Reading Ease Scale, the project description portion of the Hickory Creek EIS was written at the 10th grade level (high school sophomore). Thus, measures of comprehension based on this EIS may substantially overestimate the level of understanding attained by reading most EISs.

Testing Understanding

Measuring a reader’s understanding of a written document can be tricky. If you ask questions that require only recall to answer, an individual who has a good short-term memory for verbal items may score well without really understanding. Conversely, an individual who understands the basic idea may score low on recall if they have trouble with technical jargon that is included in many EIS documents. For this reason, we measured understanding in three ways. We asked questions that required (1) recall of the basic facts, (2) understanding the gist of the project, and (3) understanding the project’s environmental effects.

PROJECT RECALL. Five multiple-choice questions probed students’ understanding of the proposed project’s basic features. One question, for instance, asked about the type of embankment proposed for the creek, another asked how much of the creek would be bordered by a vertical concrete wall. Five possible answers were provided for each question, only one of which was correct. On these questions, blind guessing would produce one correct guess for every five questions; thus on this measure, 20% correct corresponds to performance at chance, or blind guessing.

UNDERSTANDING THE GIST. The extent to which students understood the gist of the project was assessed through a picture selection exercise. Students were presented with nine pictures, three of which showed how the Hickory Creek would look after channel improvements were completed. The remaining six images showed the creek in its current condition, or showed flood control treatments (such as a dam) that were not planned for the Hickory Creek. Students were asked to identify three pictures that most closely showed how the creek would look after the improvements were constructed.

ENVIRONMENTAL EFFECTS. Although the EIS material the students read did not contain a description of the consequences of building the flood improvements, students were asked to anticipate what those consequences

might be. Twelve true-false questions examined students' understanding of the possible impacts of the project. The true-false questions included items such as *construction of this project will require digging up material from the creek channel* (true), *the natural appearance of the Creek will be lost because of the channel improvements* (true), and *the improvements will not destroy the homes of any animals living in the water* (false).

A set of standard demographic questions was included with the test. These questions asked about the participants' age, how close they lived to the creek, their year in school, and their names. Participants' names were used only to allow the staffs at both high schools to identify scores on the most recent Comprehensive Test of Basic Skills.

Administering the Test

Both high schools allowed students to participate in this study during the school day. Each participant received the project description portion of the Hickory Creek EIS (one page) and the three maps associated with this description. Students were instructed to read the description and the maps and were told they would be taking a short quiz after they had read the materials.

The participants took an average of 20 minutes to read the material. After they completed their review, each individual handed in the study material in exchange for the test. Students took between 5 and 15 minutes to complete the test.

Results and Discussion

The analyses that follow examine how well students understood the EIS material by assessing their performance on three portions of the test—project recall, understanding the gist, and understanding environmental effects. In addition, analyses examine the understanding attained by participants of different reading abilities. Who did, and who did not understand the EIS materials?

How Much Did They Understand?

Given that federal land management plans—documents that have a great deal in common with EISs—are written for people with 3 to 6 years of college education (Gallagher and Patrick-Riley 1989), one would not expect average citizens to understand everything in an EIS. But did they have an adequate understanding—the equivalent of a “C,” or 70% correct, on the test? The answer is no, they did not have an adequate understanding. For each of the three measures of understanding, the students performed far below the 70% mark. For the five multiple choice questions measuring project recall, they answered an average 42% of the questions correct. When asked to select three images from a set of nine as a demonstration

TABLE 1. Comparison of Students' Actual Performance to Performance at Chance (Blind Guessing) on Three Measures of Understanding for the EIS Materials They Read

Measures of Understanding	Participants' Percent Correct	Percent Correct at Chance	<i>t</i> -Value (<i>df</i> = 112)	<i>p</i> -Value
Project recall	42	20	9.0	<0.0001
Understanding the gist	40	33	3.5	<0.001
Environmental effects	57.5	50	4.4	<0.0001

that they understood the gist of the proposal, they selected an average 40% correct. For the 12 true-false questions concerning environmental effects, they averaged 57.5 correct. Thus, the EIS materials were understood at a level far below a "C." The students' performance was far less than adequate.

Although their performance was clearly less than adequate, did the participants get anything out of reading the EIS materials? A one-sample *t*-test was used to see if the students' performance was better than if they had read nothing at all; that is, whether their performance was better than chance. It was. Students did learn something from the EIS materials. As Table 1 reveals, in each of the three portions of the test, students performed significantly better than chance. Thus, although the EIS materials did not convey an adequate level of understanding, they did convey some information about the proposed changes to the Hickory Creek.

Who Understood?

When compared with their peers who read less well, did the more skillful readers understand the EIS materials better? Ordinary least squares (OLS) regression analyses between an individual's reading ability, and their performance on the three measures of understanding revealed a strong relationship between reading ability and test performance. The more skillful the reader, the higher the test score. This held true for the test of Project Recall, $R^2 = 0.05$, $p = .02$; for Understanding the Gist, $R^2 = 0.07$, $p < .005$; and for Understanding the Environmental Effects, $R^2 = 0.08$, $p < .01$. Thus, individuals with better reading ability understood the EIS materials significantly more than the less advanced readers.

At what reading level did understanding occur? Reading comprehension scores were used to divide the participants into two groups—those who read at or below the national 70th percentile, and those who read in the highest 30th percentile. Did either of these groups have what we have defined as adequate understanding—70% correct? No, neither group achieved an adequate understanding. Even the participants who performed best on the three measures of understanding, those whose reading ability

was in the highest 30th percentile nationally, answered significantly fewer than 70% of the questions correctly. These students performed below 70% on Project Recall, $t(42) = -5.8, p < .0001$; Understanding the Gist, $t(42) = -6.1, p < .0001$; and Understanding the Environmental Effects, $t(42) = -2.2, p = .03$. Not surprisingly, the students who read at or below the national 70th percentile performed significantly below the 70% mark on each of the three measures of understanding. Thus, not only did the EIS materials fail to communicate an adequate level of understanding to the students as a whole, they also failed to communicate an adequate understanding to the very best readers.

At what reading level did participants perform better than chance? That is, at what reading level did students perform better on the three measures of understanding than if they had not read any of the EIS materials? To answer this question, reading comprehension scores were again used to divide the students into two groups. This time the groups consisted of those who read at or below the national 50th percentile, and those who read in the highest 50th percentile. The results produced an interesting pattern. Even the least skilled readers, those in the lowest 50th percentile, performed significantly better than chance on the Project Recall portion of the test, $t(36) = 3.6, p = .001$. The performance of these same individuals, however, was indistinguishable from chance on Understanding the Gist, $t(36) = -0.5, p = 0.64$; and Environmental Effects, $t(36) = -0.5, p = .64$. Participants whose reading comprehension was above the 50th percentile scored significantly better than chance on each of the three measures of understanding.

Based on this comparison, it seems that half the readers, those reading in the lower 50th percentile, are understanding absolutely nothing on two of the three measures of understanding. The news, however, may not be even that hopeful. In addition to dividing the students into groups around the 50th percentile, we made an additional comparison that included some of the above average readers with the below average readers. We compared students who read at or below the national 70th percentile, to those who read in the highest 30th percentile. Here again, the question was whether either group was performing better than chance on the three measures of understanding.

The pattern that emerged from this analysis was identical to that of the previous analysis (see Figure 1). In this case, most of the readers, those in the lowest 70th percentile, performed significantly better than chance on Project Recall, $t(64) = 6.01, p = .0001$. The performance of these same individuals, however, was indistinguishable from chance at the $p < .05$ level on Understanding the Gist, $t(64) = 1.9$; and on Environmental Effects, $t(64) = 1.9$. Participants whose reading comprehension was in the highest 30th percentile scored significantly better than chance on each of the three measures of understanding.

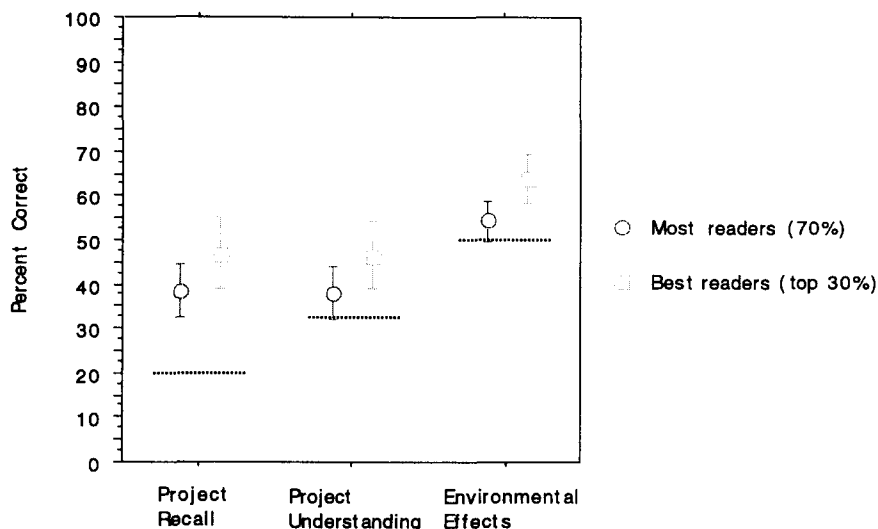


FIGURE 1. Percent correct, and amount different from chance (blind guessing), on three measures of understanding for two groups of readers. Error bars describe the 95% confidence interval.

Taken together, the results describe a situation that is tremendously ineffective, and that deserves considerable attention. None of the participants had an adequate understanding of the EIS materials they read. In fact, for two of the three measures of understanding, most of the participants, those reading at or below the 70th percentile, performed at a level indistinguishable from chance—for these two measures the majority of participants understood at the level of someone who had not read the EIS materials at all.

Consequences

What are the consequences of not addressing these concerns? One consequence is that agencies lose the opportunity to describe a proposed project to citizens. When citizens do not understand the material presented in an EIS, they often rely on other sources of information—newspapers, consultants, special interest groups—to learn about the proposed project. For a variety of reasons, these alternative sources may not convey an accurate, or complete, understanding of the proposed project. The sequence of events that pits experts writing the EIS against experts reviewing the EIS for the public, clearly works against the agency and against the public participation process.

An agency that fails to produce an EIS that citizens understand opens itself to law suits. Citizens and special interest groups have brought suit against agencies for producing EIS documents that are difficult to understand (e.g., *Oregon Environmental Council v. Kunzman* 1985; *Sierra Club v. Froehlke* 1973). For an agency to defend itself again such suits must be considerably more costly than producing an EIS that citizens understand in the first place.

An additional cost an agency may shoulder by producing an EIS that citizens do not understand grows from a lost opportunity to tap into the knowledge and experience of local citizens. "The diverse perspectives citizens provide could otherwise be obtained only through extensive fieldwork by the agency sponsoring the project" (Jain et al. 1993, p. 237). Because field work is often tremendously expensive—an expense many agencies cannot afford—information about local resources and limitations that may affect the proposed project must come from citizens. When citizens cannot understand the EIS materials, they are not likely to provide the kind of information that would be beneficial to the project, or to the agency.

When compared with the projects that emerge from an EIS process in which citizens have very little participation, more viable and innovative alternatives to a project emerge when citizens participate more fully (Bendix 1984; Jain et al. 1993; Weiss 1989). Because knowledge and understanding are prerequisites to participation (Kaplan and Kaplan 1982), failure to understand precludes participation. Certainly all government agencies have a stake in developing and carrying through the most viable projects possible. Finding ways to produce EISs that citizens understand is therefore an investment not only in the specific project at hand, but in positive public attitudes toward the agency as well.

Addressing the Problem

Is it possible to produce an accurate, relevant, EIS that the majority of citizens understand? There is reason to believe it is possible. Authors of EISs can make their writing easier to understand by using appropriate typographic standards (Baird et al. 1987; Gallagher and Jacobson 1993; Moen 1989); providing cues in headings and in text that help readers identify and understand important points (Leach 1993; Weiss 1982); and by using simple language with minimal technical jargon (Axline and Bonine 1990; Ryan 1993).

In addition to these proven strategies, there is another possibility that requires investigation. Computer visual simulation offers an inexpensive yet powerful technique for creating realistic photographs that enable people to see the impacts of proposed projects that have a visible effect on the land (Sullivan, 1994). EISs might be made easier to understand if they included visual simulations. Given the wide spread availability of simulation software, and the potential that these techniques have for helping citizens

understand proposed projects, their use in EIS documents merits future research.

Conclusions

It is no secret that EISs are difficult to read—that they have been established by experts in reading (Weiss 1989), by empirical research (Gallagher and Patrick-Riley 1989), and by various courts (Oregon Environmental Council v. Kunzman 1985; Sierra Club v. Froehlke 1973). The first contribution of this work is to quantify the impact of too high reading levels on citizen understanding. On two measures of understanding, the majority of readers understood this project description no better than an individual who had not read it. These findings suggest that an EIS written at a 10th grade reading level will completely fail to equip citizens with the necessary knowledge to participate in decisions about the project.

Gallagher and Patrick-Riley's (1989) finding suggests that the vast majority of EISs are written above the 10th grade reading level. If this is the case, it would appear that the vast majority of EISs are not fulfilling their charge. It is therefore appropriate to call for public agencies to examine if, and how well, citizens comprehend the EIS documents they produce.

A second contribution of this work is a technique and procedure for assessing citizens' understanding of an EIS document. Agencies that produce EISs could use the technique and procedure described here to examine how well their materials are understood by the public. In this study, we found both high schools willing to participate because the flood control plans presented an interesting local civic issue; we anticipate that for similar reasons, EIS documents describing significant changes to a community will generally be of interest to local high schools. Moreover, it takes little time to devise and administer a short multiple choice test. We call on public agencies to make it a standard procedure to examine citizens' understanding of the EIS documents they produce, and suggest the procedure described here as a relatively efficient, low-cost way of doing so.

This research was supported by a grant from the National Consortium for Environmental Education and Training at the University of Michigan and through the Office of Environmental Education at the U.S. Environmental Protection Agency; our thanks to both institutions. We also thank the administrators, teachers, and students at Joliet West, and Joliet Central High Schools for their interest and participation in this study.

References

- Axline, M., and Bonine, J. 1990. Plain talk: Making NEPA work. *Land and Water Law Review* 25:70.
- Baird, R.N., Turnbull, A., and McDonald, D. 1987. *The Graphics of Communication: Typography, Layout Design, Production*, New York: Holt, Reinhart and Winston.

- Bendix, S. 1984. How to write a socially useful EIS. In *Improving Impact Assessment: Increasing the Relevance and Utilization of Scientific and Technical Information*, Hart et al. (eds). Boulder, CO: Westview Press.
- Burchell, R.W., Listokin, D., Dolphin, W.R., Newton, L.Q., and Foxley, S.J. 1994. *Development Impact Assessment Handbook*, Washington, DC: Urban Land Institute.
- Diehl, W., and Mikulecky, L. 1981. Making written information fit workers' purposes. *IEEE Transactions on Professional Communication* 24:5-9.
- Flesch, R.F. 1974. *The Art of Readable Writing*, New York: Harper.
- Gallagher, T.J., and Jacobson, W.S. 1993. The typography of environmental impact statements: Criteria, evaluation and public participation. *Environmental Management*. 17(1):99-109.
- Gallagher, T.J., and Patrick-Riley, K. 1989. The readability of federal land management plans. *Environmental Management* 13(1):85-90.
- Jain, R.K., Urban, L.V., Stacey, G.S., and Balbach, H.E. 1993. *Environmental Assessment*, New York: McGraw-Hill.
- Kaplan, S., and Kaplan, R. 1982. *Cognition and Environment: Functioning in an Uncertain World*, New York: Praeger (republished by Ulrich's, Ann Arbor, MI).
- Ketcham, D. 1988. How does the scoping process affect the substance of an EIS? In *Environmental Impact Assessment—Proceedings of a Conference on the Preparation and Review of Environmental Impact Statements*, N.A. Robinson (ed). New York: New York State Bar Association.
- Klare, G.R. 1963. *The Measurement of Readability*, Ames, IA: Iowa State University Press.
- Leach, J. 1993. Seven steps to better writing. *Planning* 4:26-27.
- Moen, D.R. 1989. *Newspaper Layout and Design*, Ames, IA: Iowa State University Press.
- Oregon Environmental Council v. Kunzman, No. 82-504-RE (D. Or. May 21, 1985).
- Ryan C. 1993. Using EISs as an introduction to technical writing. *Technical Communication Quarterly* 2:205-213.
- Sierra Club v. Froehlke. 359 F. Supp. 1289 at 1342-43 (S.D. Tex. 1973).
- Sinclair, J., and Diduck, A. 1995. Public education: An undervalued component of the environmental assessment public involvement process. *Environmental Impact Assessment Review* 15:219-240.
- Sullivan, W.C. 1994. Imagining the future: Tools for assessing citizen's reactions to proposed policies. *The Fifth International Symposium on Society and Resource Management: Book of Abstracts*, pp. 280-281.
- Weiss, E. 1982. *The Writing System for Engineers and Scientists*, NJ: Prentice-Hall.
- Weiss, E. 1989. An unreadable EIS is an environmental hazard. *The Environmental Professional* 11:236-240.