

WASTE NOT: THE SPECIAL IMPACTS
OF NUCLEAR WASTE FACILITIES

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ABSTRACT

It has become common practice in discussing socioeconomic impacts to note that nuclear waste repositories tend to have "special impacts" in addition to the impacts more conventionally associated with any large-scale industrial facilities in rural areas. Drawing on accumulated survey research, this paper asks whether nuclear facilities are actually seen by the public in a more negative light than other industrial installations. Evidence is drawn from numerous surveys on nuclear power plants and from the more limited number of surveys to date on nuclear waste facilities; both bodies of findings support the hypothesis that nuclear installations are indeed "special" in the negative reactions they inspire. The opposition cannot be explained as resulting from "irrationality"; it appears to reflect instead a loss of trust in the nuclear industry and the federal agencies that are supposed to regulate it.

After many years of virtual neglect, the social and political aspects of nuclear energy development and nuclear waste disposal have come to receive increasing attention in recent years.¹ It has come to be conventional wisdom among energy policy analysts that "social considerations" could prove to be as important to the future of nuclear power development as are all technical aspects combined.² To date, however, the social considerations have tended to be addressed, if at all, only in an intuitive or unsystematic way.

Yet there is no law of nature that requires the scientific method to be abandoned simply because questions of human behavior are involved. Indeed, the social and political issues appear to deserve the same kind of rigorous, systematic investigation that has been devoted to the more technical issues.

Particularly in need of attention is the issue of "special" impacts. It is common in studies of the socioeconomic impacts of nuclear waste facilities to speak of "conventional" and "special" impacts as relatively distinct categories. To follow the definitions used by a recent panel of the National Academy of Sciences,³ "conventional effects" are those that occur when any large-scale industrial facility is located in a rural community, while "special" impacts or effects are those that are "associated with the radiological characteristics" of a repository and "arise as a result of the special characteristics of a repository for radioactive wastes" (p. 100, p. 85). In addition to noting that the special impacts will need to be studied far more extensively before they can be considered to be well understood, the Academy panel identified four categories of special impacts or effects deserving special attention: (1) Public concerns; (2) Equity across regions and across generations; (3) The national debate over nuclear power; and (4) Institutional issues -- credibility of institutions, long-term security of site, waste transportation, and roles in decision making (p. 100). Rather than dealing with all four categories of special impacts, this paper will focus on public concerns and their likely consequences, emphasizing the repository-siting implications that result.

To date, little has been presented by way of quantitative evidence on just how "special" nuclear

waste facilities are likely to be in the public reactions they inspire. The question obviously has more than academic importance; one of the oldest principles in the social sciences is that, if people perceive a situation to be real, it will be real in its consequences. Moreover, while the accumulated body of scientific polling data is not yet sufficient to provide definitive evidence on just how significant the special impacts are seen as being by representative cross-sections of the public, it is possible to gain insight by drawing on two types of data that are already available. First, many years' worth of accumulated survey data are now available on public reactions to nuclear power plants, and second, a small number of early surveys provide preliminary evidence about public perceptions of nuclear waste facilities, in particular. This paper will summarize these two bodies of work, beginning with data on attitudes toward nuclear power plants.

CHANGES IN ATTITUDES TOWARD NUCLEAR POWER PLANTS

While there are many ways to measure attitudes toward nuclear power facilities, three types of attitudinal data have particular relevance to nuclear energy policy. The first category includes surveys that ask the general public about "nearby" facilities. The second category also has to do with nearby facilities, but is limited to surveys of persons in "host communities" -- the localities in or near which nuclear power facilities are under construction or have recently been completed. The third category, the broadest, includes attitudes of the national public toward the general idea of nuclear power. All three have been summarized in a forthcoming *Policy Studies Journal* article.⁴ The discussion below will draw directly from that article; readers are referred to that article and the other sources cited below for more complete bibliographic information.

National Public Attitudes Toward
Nuclear Power Plants "Nearby"

Many persons are surprised to learn that even the idea of a nuclear power plant in a respondent's own "back yard" remained relatively uncontroversial until the mid-1970s. As can be seen from the data shown in Fig. 1, a pair of polls in the early 1970s found over 55% favorability, with roughly half that level of

opposition, when national samples were asked about having "the local electric company . . . build a nuclear power plant in this area," and one poll in the 1950s indicated even less concern. But opposition to local nuclear facilities began to increase by the mid-1970s. By 1978, several months before the Three Mile Island accident, opposition actually exceeded support for the first time. As can be seen from Fig. 1, however, the Three Mile Island accident was associated with even greater opposition, and a further decrease in favorability, toward the idea of a nuclear power plant "in this area."

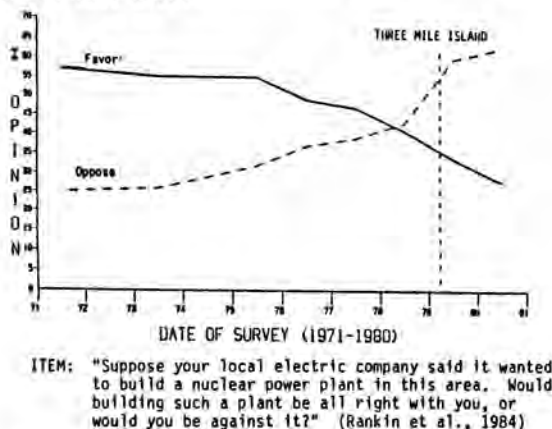


Fig. 1. Attitudes Toward Nearby Nuclear Power Plants, Over Time (National Samples).

A second approach to measuring the acceptability of a "local" power plant is to specify an actual distance -- as in the question "do you favor or oppose having a nuclear power plant within five miles of your community?" Rankin and his colleagues⁵ summarized four surveys using this approach that were done by the Gallup and Harris polling organizations; they found that support for a local nuclear facility was almost equal in opposition in 1976, but that opponents outnumbered supporters by a 57%-to-37% average in the three polls done in 1978, 1979 and 1980. The idea of nuclear power in the abstract was viewed more favorably, being supported by an average of 57% and opposed by an average of 41.7% of the respondents across the three later surveys.

Another national survey appears to show the same pattern. The Resources for the Future "National Environmental Survey," which was performed by Roper and Contril for the President's Council on Environmental Quality in 1980, attempted to measure the "tolerance distance" for five types of facilities (an office building, a large factory, a nuclear power plant, a coal-fired power plant, and a disposal site for hazardous waste chemicals). Respondents were asked to say how close such facilities could be built to their own homes "before you would want to move to another place or to actively protest." Even the disposal site for hazardous waste chemicals was slightly more popular (at a mean distance of 81.4 miles) than was the nuclear power plant, which had a mean tolerance distance of 91 miles.⁶ In short, while there are a number of variations among these different approaches, all of them display the same general pattern: representative national surveys of the U.S. public show considerable opposition to the idea of having a new nuclear power plant constructed nearby.

Attitudes of Nuclear Host Community Residents

While national attitudes toward nuclear power have obvious implications for the future development

of the technology, there is a more direct relevance in the attitudes of actual "nuclear neighbors" -- the people living in the specific communities that host nuclear power facilities.

Historically, nuclear host communities have been far more favorable toward nuclear power development than have cross sections of the U.S. public.⁷ Recent evidence strongly suggests, however, that host community support can no longer be taken for granted. Surveys since the Three Mile Island accident have shown that even host communities can show significant opposition to nuclear facilities. The most comprehensive summary to date⁸ draws on the results from 36 host community surveys (at 15 individual reactor sites) that were all done after local residents became aware of the facilities, but before the facilities had completed their first six months of operation. While methodological variations across surveys were substantial, the overall pattern was quite clear, as can be seen from Fig. 2. In none of the surveys conducted before the Three Mile Island (TMI) accident was opposition found among more than 33% of the population; in no known surveys since Three Mile Island has there been less than 50% opposition. In regression analyses using the dependent variable that Rankin and his colleagues⁹ call the "Index of Acceptability" ($\% \text{favor} \div [\% \text{favor} + \% \text{oppose}]$, a variable that focuses on favorable respondents as a proportion of those expressing an opinion), the Freudenburg-Baxter research found that a dummy variable for pre/post-TMI status explained over 70% of the variation across surveys. This finding held despite major variations in question wording, survey locations, and other factors that would normally tend to attenuate the explained variance in such an analysis.⁸

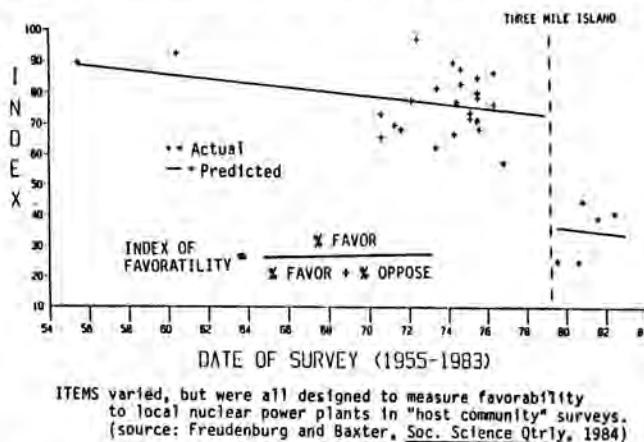
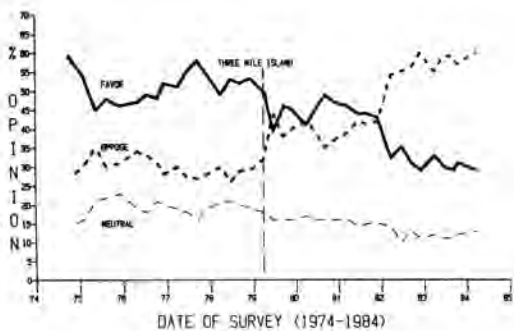


Fig. 2. Host Community Attitudes Toward Local Nuclear Power Plants, Before/After Three Mile Island.

National Public Attitudes Toward Nuclear Power Plants "In General"

Data in this third category appear to be the type most frequently cited in policy documents, such as the recent analysis by the Office of Technology Assessment, and this is also the category in which it has been possible to obtain the most recent data. Two national polling organizations have played a particularly important role in documenting national attitudes toward the general idea of nuclear power plant construction -- Louis Harris Associates, and Cambridge Reports, Inc. As summarized by Rankin and his colleagues,⁵ the data from the two organizations are quite similar over the period for which comparable data are available; supporters outnumbered opponents by margins averaging 20% to 30% in more than twenty

separate surveys that were taken before the time of the TMI accident. The accident was associated with a significant increase in the number of opponents, and smaller declines both in supporters and in "undecided" persons, with the net result being that almost a two-to-one margin of support before the accident became a roughly even split between supporters and opponents of the technology immediately thereafter, although supporters still outnumbered opponents in most polls. But while many analysts of public opinion (including the present author) once expected public support to climb back toward earlier levels of favorability once the Three Mile Island accident receded from consciousness, just the opposite has happened. As can be seen from the data in Fig. 3, the more recent quarterly surveys by Cambridge Reports, Inc., show that opposition has continued to increase since late 1981, with each of the polls over the last two years showing that opponents outnumber supporters by roughly two-to-one -- almost a mirror image of the situation that existed before Three Mile Island.^{4,10,11}



ITEM: "Do you favor or oppose the construction of more nuclear power plants?" (Cambridge)

Fig. 3. National Attitudes Toward Constructing Hypothetical Nuclear Power Plants, Over Time.

Another approach to measuring the favorability of the general public is to compare attitudes toward nuclear power with attitudes toward other energy technologies. This approach also fails to indicate significant support for nuclear power. In fact, nuclear power tends to receive less popular support than any other energy supply option except for importing more oil.^{6,12}

ATTITUDES TOWARD RADIOACTIVE WASTE REPOSITORIES

When we turn to nuclear waste repositories, more specifically, we can find two bodies of relevant data. The first is by far the larger of the two, although its relevance is somewhat indirect, since this literature deals with concerns over radioactive waste disposal as providing reasons for survey respondents to oppose nuclear power. In a nutshell, most members of the general public showed relatively little concern over the waste management issue until the early 1970s, when the interaction of several factors appears to have led to a greatly increased salience for the issue. In particular, the nation's increased concern about environmental matters, which also became evident in developments such as "Earth Day" and the passage of the National Environmental Policy Act, coincided with a number of setbacks in the efforts to deal with radioactive wastes. The more-attentive public began to hear much more, both from environmental groups and from the media, about a number of these setbacks -- e.g., the problems at the reprocessing facility at West Valley, New York, that eventually led to the

closure of that installation, the technical shortcomings and criticisms that eventually led to abandonment of efforts to develop a repository in an abandoned salt mine near Lyons, Kansas, and the leakage of over 100,000 gallons of liquid radioactive wastes that were being stored at the Hanford Nuclear Reservation in Washington State. Reviews of the issue^{13,14,15,16} note that, since the early 1970s, nuclear wastes have been mentioned frequently in the national surveys as a reason for opposing further nuclear power development. Even so, the issue is not as polarized as it might otherwise appear, since supporters as well as opponents of nuclear power tend to report feeling that radioactive waste disposal is an issue of importance, and one with which the nation must deal (for additional analyses of attitudinal data, see especially the research from the Battelle Human Affairs Research Centers in Seattle^{15,16}).

The second body of work is much more directly relevant to the siting issue, but also much smaller and more difficult to locate, than is the first. Surveys that quantify actual receptivity to potential nuclear waste repositories are remarkably few in number. (The surveys reported here, however, are almost certainly not an exhaustive listing, particularly given the difficulties of locating the relevant data; if readers are aware of other data sets that are even indirectly relevant, I would be quite grateful to learn of those studies' existence.) The available data set, however, suggest what many have already feared: It may prove to be even more difficult to find acceptance for a nuclear waste repository than for a nuclear power plant.

Some of the earliest evidence to that effect comes from a survey done by the Battelle Human Affairs Research Centers in 1978. Although that study's sample was not intended to be representative either of the population at large or of potential host communities, focusing instead on politically active persons who were selected to range from pro- to antinuclear in their attitudes, it did include an assessment of "tolerance distances" for eight industrial facilities (including a nuclear power plant and a nuclear waste repository). The politically active respondents in the Battelle study were apparently somewhat more tolerant of nuclear plants than was the post-Three Mile Island national sample described above: While the mean tolerance distance for the national sample was 91 miles, 40.9% of the Battelle respondents were willing to live within ten miles of a nuclear power plant. (Only 39.3% of the Battelle respondents were willing to live within the same distance of an insecticide factory.) A nuclear waste facility was significantly less tolerable, however, even to this group, in fact, a nuclear waste repository clearly proved to be the least "tolerable" of the eight facilities in the study, with only 29.2% of the respondents saying they would be willing to live within ten miles of a repository, and with 32% saying they would not be willing to live within a hundred miles.^{16,17}

More recent surveys have shown more direct relevance. A statewide survey of Washington State residents in the fall of 1983 is of interest largely because the connection it suggests between attitudes toward nuclear power plants and attitudes toward a potential waste repository. (Although the questionnaire was evidently designed to deal with nuclear waste issues, the main report from the study¹⁸ includes five items on the acceptability of a nuclear power plant but none focusing on a potential nuclear waste repository.) The respondents were asked, however, to identify potential benefits and problems associated with a potential repository in Washington

State; 90% of the respondents named at least one problem, while 41% specifically said there would be "no benefits." Attitudes toward nuclear power were also associated with perceptions of the solvability of nuclear waste problem; 76% of the persons favoring the construction of more nuclear power plants believed that the waste problem could be solved, a proportion almost three times as high as the 29% who shared the same belief among persons most strongly opposed to further nuclear power plant construction. When respondents were given a specific list of potential problems and benefits, the persons favoring construction of more power plants agreed with the assessments of all potential benefits, and disagreed with the assessments of all potential costs, significantly more often than did those who wished to see no additional construction and/or to have currently operating nuclear power plants shut down.

The data most directly relevant to repository siting appear to come from the two most recent surveys, which also appear to be the most sound, methodologically, of the repository surveys to date. Both surveys were done in Texas during 1984, and both confirm that potential repository "host communities" in that state are less than thrilled about welcoming radioactive wastes as new neighbors.

In the first of these two studies, the focus was on a pair of counties in the north Texas panhandle that have been identified by the Department of Energy as "potentially acceptable sites" for the nation's first high-level nuclear waste repository, along with a pair of comparison counties nearby. Of a dozen potential industrial developments that were specifically mentioned in this survey, all but three were favored by a majority of the survey respondents. The three exceptions were a nuclear power plant (favored by about 18% of the respondents), a low-level nuclear waste disposal site (favored by about 10%) and a high-level nuclear waste repository, which was favored by about 7%. On a slightly different question -- asking not how the respondents felt about a repository but "if it were up to you, would you allow construction of a high level nuclear waste repository" nearby, only about 10% of the respondents would have allowed construction, while 82% would not.¹⁹

The second Texas survey was done in twelve different Texas counties, and it focused on low-level rather than high-level nuclear wastes, but the results were quite similar. Overall, 80% of the respondents in this survey opposed "the placing of a low-level radioactive site" in their respective counties, while only 8% were in favor. These respondents were evidently also closer to the national average in terms of their tolerance distance for nuclear waste facilities than were the political activists in the Battelle study: While mean distances were not reported, the median tolerance distance for a low-level radioactive waste disposal site -- the distance required between that site and the respondent's home or work "in order for you to feel safe from harm" -- was 90 miles.²⁰

In addition to the fact that the respondents in the first of the two Texas surveys were even more strongly opposed to a nuclear waste repository than to a nuclear power plant, the computation of an "Index of Acceptability" (the statistic used in Fig. 2 of this paper) shows even more clearly that host community support can no longer be taken for granted. The lowest level ever recorded on this index in a known survey of a nuclear power plant host community was the score of .242 at Three Mile Island. Only about 24% of the respondents with an opinion, in other words, were favorable toward the TMI facility at the time of that

survey, which took place just four months after the infamous accident. In both sets of Texas surveys, the Index of Acceptability is less than half that high -- .091 for the low-level waste counties and .113 for the high-level waste counties. The difference between these two scores is probably too low to be meaningfully interpreted, particularly given a number of differences between the two sets of Texas counties. It does appear likely, however, that at least in the absence of significantly different circumstances, either a high-level or a low-level nuclear waste repository could prove to be even less popular than a new nuclear power plant.

IMPLICATIONS

The hypothesis about the "special" nature of nuclear waste facilities is supported by these data; according to the best evidence currently available, nuclear waste facilities are indeed likely to be "special" in the reactions they inspire.

There is still a great need for additional research; the present data base is spotty, and future research will need to focus on entire host states as well as on potential host communities. To provide an illustration, albeit one that is based on informal impressions rather than on quantitative research, I would not be surprised if the residents near the Hanford Nuclear Reservation in Washington State were to be favorably disposed to the idea of having a high-level radioactive waste repository in that location (although I have not yet seen data either to support or refute this possibility). The Nuclear Waste Policy Act, however, gives to governors or legislatures of affected states (and not to local communities) the right to issue a "Notice of Disapproval" or veto of a repository within the state's borders. (Different provisions apply in the case of a potential facility on an Indian reservation.) Washington State's public figures would scarcely be expected to overlook the fact that a statewide referendum in 1980, which would have limited future nuclear waste disposal activities in the state, passed by a three-to-one margin -- despite an advertising campaign against the proposal that was the most expensive in the state's history up to that point. (The potential site at Lyons, Kansas, may have suffered a similar fate of being defeated by statewide opposition despite local support for the facility.¹⁴)

From a practical point of view, perhaps an even more pressing need is for research on the opportunities for repository siting that have already been lost, and to learn as much as possible from these earlier experiences. In the state of Mississippi, for example, local citizens appear to have been cautiously supportive of the idea of a nuclear waste repository when it was first proposed, particularly given the importance of economic development in a state that has historically been one of the poorest in the nation. While support might have been the rule in the early days, however, it is clearly the exception at present. The "potentially acceptable sites" in Mississippi no longer appears to be the least bit "acceptable" either to nearby citizens or to the state. There is literally no organized local pro-repository group, while there are numerous and quite well-organized opponents; one of the Department of Energy's hearings on its draft environmental assessments (in February 1985) turned into a "near-riot," according to local newspapers, and it is even becoming difficult to find anyone who will admit feeling favorable toward the repository. The case is already destined to go down in history along with proposals for the "race-track" MX missile in Nevada and Utah²¹ as a classic example

of "doing everything wrong," but it would still be useful for the future of the nation's radioactive waste repository program for qualified social scientists to take a closer look at the situation to find out what, specifically, caused most of the problems.

But while an expanded research base is badly needed, what can we learn from the existing research about the reasons for the decline in support for nuclear facilities? While conclusions need to be drawn with caution, it appears likely that much of the answer would come down to two factors.

The first factor would be the matter of values. This does not imply that the public is in any way "irrational," as nuclear proponents have sometimes claimed, but rather notes that most people see the world with a different set of priorities than are found among the "average" nuclear power scientist or technician.

It is sometimes assumed that, since "the people who know nuclear power the best" -- the persons working in the nuclear industry -- tend to be favorably inclined toward it, this means that opponents of nuclear facilities are either irrational or in need of "education." This interpretation probably helps bring a small degree of comfort to an industry that is badly in need of good news, but it cannot be supported on the basis of empirical evidence.^{13,10,11,16,22} The difference appears to be due instead to differing answers to the kinds of questions that cannot be answered scientifically -- such as "how safe is safe enough?" One study, for example, found that nuclear technologists would be about as satisfied with one death per year in the long run from radioactive wastes as would environmentalists with one death in a hundred years.¹⁶ Nuclear power supporters see the world in a way that is neither more nor less rational than the viewpoint of nuclear supporters; it is simple, if deeply, different.¹

The opponents also outnumber the supporters today, particularly when we are speaking of facilities planned for a respondent's own "back yard" -- a situation that has changed rather substantially in the last ten years -- and this leads rather naturally to the question of what has caused the change. It is less easy to know what caused this change, on the basis of existing evidence, than to refute the assumption of "irrationality." The hypothesis that seems to have the greatest merit, however, is that the decline reflects a loss of trust in the nuclear industry and the federal agencies that are expected to regulate it.

In fact, Americans are not "anti-science"; to the contrary, scientists are still held in quite high regard.²³ Rather, the nation seems to have an ambivalence about certain types of science, an ambivalence that reflects a kind of lay rationality. In general, Americans have been willing to give the benefit of the doubt to new technologies, and even to be quite enthusiastic about them, so long as they have reason to believe that the persons involved with the technology know what they are doing and are deserving of public trust. When they see reasons for concern, however, they are likely to react with a "better safe than sorry" approach; if the loss of trust is substantial, it can be extremely difficult if not impossible to reverse. The reasons for concern, moreover, include not only evidence of technological problems but also the inferences that are drawn from the interpersonal style of the technology's spokespersons --

particularly such characteristics as arrogance or an unwillingness to recognize the legitimacy of public concerns -- and most of all in the case of behaviors that seem to imply that the industry and its supporters have "something to hide."

When the recent Secretary of Energy, Donald Hodel, said in a Texas statement before last November's election that "One of the safest activities ever undertaken by man will be the handling of nuclear wastes,"²⁴ he may have reassured some of the people in his audience, but he undoubtedly reminded some of the others of the fact that past public pronouncements of the nuclear industry have almost erred on the side of overstating the industry's benefits and understating its costs. The phrase "too cheap to meter" comes to mind,²⁵ as does Daniel Ford's critical assessment of the history of the nuclear industry in the U.S.²⁶ Even granting that the "too cheap to meter" comment may have been more a case of enthusiasm over the industry's promise than a literal economic projection, the fact remains that the literal economic projections have also proven to be uniformly short of the mark. A Department of Energy sample of commercial nuclear power reactors that were completed or near completion in recent years showed that not one of the 57 facilities had been completed for its originally estimated cost or less; over three-fourths of the reactors cost more than double what they had originally been expected to cost, and roughly half cost more than four times the original estimate.²⁷ While many of these cost overruns are understandable, so are the public reactions to them; when faced with the difference between promise and performance, the public comes to be understandably skeptical about the promises -- including future promises that come from the same industry.

The situation, in sum, is not one that will make it easy or simple to find a community that will be willing to accept a nuclear waste repository. While the past is a given, however, the future is not. My own judgment is that it is not yet too late to learn the lessons of the past in a way that will lead to program improvements in the future. Indeed, any reader that is still attending to the message and the analysis of this paper -- who is trying to understand public reactions, in other words, rather than merely condemning them -- is already taking the first step. To reiterate the point of view that began this paper, it is not only possible but necessary to study public reactions -- devoting to them the same kind of careful, scientific analysis that has been devoted to other aspects of the issue. And while the time is already late, it may not yet be too late for that process to begin in earnest.

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