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**Public Information on Radioactive
Waste: A Study of an
Emerging Issue**

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UNION CARBIDE CORPORATION
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**PUBLIC INFORMATION ON RADIOACTIVE WASTE:
A STUDY OF AN EMERGING ISSUE**

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DISCLAIMER

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HIGHLIGHTS

PUBLIC INFORMATION ON RADIOACTIVE WASTE: A STUDY OF AN EMERGING ISSUE

The purpose of this study is to provide information to decision-makers which will assist in the task of formulating policies for radioactive waste management so that the policies address the concerns and interests of the public. Through an analysis of information provided in the printed media on the topic of radioactive waste, the study analyzes the emergence of radioactive waste as a public issue in the press. Over eight hundred articles printed in both specialized and non-specialized sources from 1973 to 1978 have been content-analyzed in order to describe how the problem of radioactive waste is defined and what dimensions of the problems are receiving attention. Data on the content of information are differentiated by source of information (i.e., national press; general scientific press; industry/utility press; nuclear scientific press; environmental press; and local press) and over time. Major findings include:

1. In the six year period between 1973 and 1978 there was a substantial increase in the amount of information on the topic of radioactive waste available to the public through a variety of popular and specialized media sources. The increase in information coincides with documented public concern with the problem of radioactive waste.
2. Discussions of radioactive waste have focused for all sources more frequently on themes not directly related to the technical problems of radioactive waste storage or isolation.
3. A substantial amount of the information available to a variety of segments of the public is composed of discussions of real or perceived risk related to the existence of waste or to methods of disposing of it.
4. In addition to risk, a substantial proportion of the discussions deal with institutional themes.
5. Over time, the total amount of information on most dimensions of the radioactive waste problem has increased substantially. Institutional themes have gained relative to other issues over the three time periods.
6. Information sources do vary in the relative attention which each gives to dimensions of the radioactive waste problem. Overall, the broad patterns are quite similar, however.
7. National and local press sources infrequently specify the form of waste being discussed thus providing evidence that the quality of technical information available to some members of the public is very low.

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I. INTRODUCTION

The problem of radioactive waste management has become increasingly apparent to government officials and to the broad public. The President's announced concern with the radioactive waste problem,¹ coupled with the creation of an Interagency Review Team to study various policy alternatives,² highlights the importance of this issue on the formal decision making agenda.

The renewed efforts to find realistic and practical solutions to the radioactive waste problem are partially in response to public concern and/or opposition to existing policies. New policies which are formulated are expected to meet these concerns and to promote public acceptance.³ The purpose of this study is to provide information which will assist in the task of discerning public concern. Through an analysis of information provided in the printed media on the topic of radioactive waste, the study describes the emergence of radioactive waste as a public issue in the press. Eight hundred twenty-six articles printed in both specialized and non-specialized sources during the period 1973-1978 were reviewed in order to describe how the problem of radioactive waste is being defined and what dimensions of the problems are receiving attention.

Our attention is focused on the media because it is an important factor which draws the attention of the public to policy problems and contributes to the emergence of an issue on the public agenda where, in the view of a sizeable proportion of the public, it requires governmental action.⁴ Moreover, the treatment which the media gives to the problem is an important factor structuring public opinion on the policy problem.⁵ Thus, while the study is not a direct measure of public opinion, it does suggest how the radioactive waste problem will be defined and what dimensions of the problem will emerge as issues for the public. As such, the study provides necessary groundwork for more direct measures of public opinion. In addition, to the extent that the media documents public debates on any policy issue, the study describes the content of the debates over radioactive waste management.

The method used to describe the content of the information available in a variety of press sources is content analysis. The bulk⁶ of research on public opinion and the effect of media coverage postulates that the content of information focuses the attention of the public on certain

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dimensions of the problem but does not determine on what side of the various issues that are raised an individual might take a position.⁷ For this reason, in our analyses we have reviewed the content of information on radioactive waste looking for broader themes, rather than narrow issues, which define the parameters of the problem. In addition, in analyzing information in the printed media, we focused on different information sources. Different presses exist which supply information to different groups within the broader attentive public. For example, the Atomic Industrial Forum's newsletter, *INFO*, with its subtitle "Public Acceptance of Nuclear Power," reaches quite a different audience and has a different purpose than the *Los Angeles Times* or the *New York Times*. Because of these differences, we have chosen to distinguish between different information sources in much the same manner that the public opinion literature distinguishes between different "publics."⁸

The sources in this study are differentiated primarily by the different audiences the publications might represent in the nuclear power controversy.⁹ The major categories chosen were: national press; general scientific press; nuclear scientific press; nuclear industry/utility press; environmental press; and local press (for Louisiana and Michigan). Government sources were excluded from our analysis because they are the basis for background information in many public sources and they primarily define what decision makers perceive as the policy problem. Our concern is not to define official policy or official concerns. Rather, our focus is on one means, public information sources, by which the policy problems are interpreted for the public.

II. SELECTING ARTICLES AND PROCEDURES FOR REVIEW

The search for articles on radioactive waste involved several steps. For discussions of radioactive waste in popular sources, the *Reader's Guide to Periodical Literature* and the *New York Times Data Bank* were consulted. All articles mentioning radioactive waste and indexed for the period January 1973 to June 1978 were included in the bibliography and content analyzed.¹⁰ To search out articles in the more specialized information sources (e.g., *Nuclear News*, *Utilities Fortnightly*, *Critical Mass*), the authors relied on the Central Research Library and the Energy and Environmental Response Center Library at Oak Ridge National Laboratory as well as the personal libraries of some of ORNL's staff. A spectrum of journals and newsletters representing different editorial policies from each specialized source was sought. For example, *Nuclear News*, *Nucleonics Weekly*, and *The Bulletin of Atomic Scientists* were included in the nuclear scientific category. Likewise *Nuclear Opponents* and *Environmental Action* were included in the environmental category. Each journal selected was searched for radioactive waste articles appearing during the 1973-1978 period, and all articles found were analyzed. In addition, the former Office of Waste Isolation, Union Carbide Corporation-Nuclear Division (UCC-ND), made available its extensive newspaper clippings from local newspapers in the States in which research was planned to determine the suitability of selected sites for hosting a radioactive waste facility. These clippings files were extensive and included articles from a variety of local newspapers in each State.

The material was then organized into broad categories based on the source of information. These categories are (1) National Press; (2) General Scientific sources; (3) Nuclear Scientific sources; (4) Environmental sources; (5) Nuclear Industry/Utility sources; and (6) Local Press. A complete listing of the sources which make up each category is contained in *Radioactive Waste: A Bibliography of Printed Media Sources, 1973-1978*, ORNL/OEPA-14 (March 1979).

The national press category included among others *Newsweek*, *Time*, *Readers Digest*, and major metropolitan newspapers. These sources most likely reach and are directed at a large portion of the general attentive public, although certainly the scientific public and other specialized

groups have access to them. We assume, however, that for some individuals the only information which they have on radioactive waste management comes from these sources. There is no reason to assume that these information sources have a pro- or anti-nuclear bias. The audience to these sources is quite broad. The *New York Times* has a circulation of 1,008,995 and the *Los Angeles Times* 803,123.¹¹

Articles from such sources as *Science*, *Scientific American* and *Science Digest* contributed to the general scientific category. These information sources reach a specialized audience. They are probably read by a broad spectrum of the scientific community. The sources carry articles and editorials on a variety of academic and policy issues of interest to their readers. Access to this information is more restricted than for the national press: *Science*, for example, comes primarily to members of the American Association for the Advancement of Science. The current membership however, totals 149,557.¹²

Articles from journals which are read primarily by members of the nuclear scientific community were also grouped together into the nuclear scientific category. These journals, we assume, reflect the interest and concerns of those involved directly in research or in decision-making on nuclear power. Included in the selection were such journals as *Nuclear News*, *Nucleonics Weekly*, and the *Bulletin of Atomic Scientists*. As might be expected, these sources provide many of the facts and figures on which a case for or against nuclear power can be made. Circulation of *Nuclear News* is 13,343.¹³

The nuclear industry/utility sources included articles and news items disseminated by the Atomic Industrial Forum, the major lobbying group for the nuclear industry; some advertisements and public relations documents developed by industry spokesmen for public use; and articles which appeared in such journals as *Electric Perspectives*, *Aware*, and *Utilities Fortnightly*. *INFO*, published by the Atomic Industrial Forum, is a publication whose function is to provide information to its members about the status of the industry in the public's view as well as its status with respect to government support and regulation. It is probably the most comprehensive summary source of information on the opposition to nuclear power since it provides

names, dates, places, strategies and reviews speeches, books, articles, and media coverage of nuclear power issues.

Environmental sources included such publications as *Critical Mass*, *Environment*, *Nuclear Opponents*, and *Nuclear Blowdown*, a Friends of the Earth Publication. These publications reach a specialized audience whose concern with the impacts of radioactive waste management most likely reflects a broader concern with environmental protection. As might be expected, the reviewed sources presented positions which were in opposition to nuclear power for electrical generation. Available estimates of the size of the publics for these publications range from 9,000¹⁴ for *Critical Mass* to 22,000¹⁵ for Friends of the Earth. The local press category included articles from Louisiana and Michigan (e.g., *The Saginaw News*, the *Detroit Free Press*, the *Minton Press Herald*, and the *Shreveport Times*).

Having collected the bibliography, summaries of each of the articles were prepared by two research assistants who were directed to record major issues or themes in each discussion as well as to code additional information as to the type of article, the year published, and the form of radioactive waste discussed. The index of agreement¹⁶ for summarizing issues was 0.86, and 0.80 for the question of how waste is defined. Using these summaries, the authors developed fifteen thematic categories which permitted classification of the different themes or issues across sources. The summary data was then coded into the fifteen thematic categories.

One thousand six-hundred themes were coded for the 826 articles. To determine the reliability of the final coding process and to recapture some of the details lost in the initial analysis, an author who was not originally involved in the coding worked back from a sample of unlabeled but similarly numbered coded themes to the summarizing statements. This process resulted in the redefinition of certain issue categories, even though great consistency was found in the information included in each category. Review of the coded thematic categories also resulted in the further organization of the fifteen thematic categories into four broader categories which reflect underlying dimensions of the policy discussion. For a detailed discussion of the major thematic categories see Sect. IV.

III. THE EMERGENCE OF RADIOACTIVE WASTE AS A PUBLIC ISSUE

In the six year period between 1973 and 1978 there was a substantial increase in the amount of information on the topic of radioactive waste available to the public through a variety of popular and special interest press sources (see Table 1). This increase in information coincides with documented public concern with the problem of radioactive wastes and as such lends support to the proposition that the media contributes to the setting of the public agenda on policy issues.¹⁷ Although, generally, more articles appeared in nuclear scientific sources, the publicity on a variety of dimensions of the problem appears to be diffused across information sources. This finding supports Schoenfeld's thesis that the agenda-setting function of the media — at least for environmental issues — is diffused and inclusive of the mass media.¹⁸

While the increase in press coverage from 1973 to 1978 is apparent, discussions of radioactive waste did not emerge for the first time in either the popular or the specialized presses during this period. A review of only those articles included in the *Reader's Guide to Periodic Literature* from 1945 to 1973 indicates that radioactive waste first gained some media attention in more popular sources after the dropping of the nuclear bomb in Japan. In 1947-49, there were three articles mentioned in the *Guide*. This attention was increased substantially from 1955 to 1963 during the policy debates over atmospheric testing. (Approximately 19 articles appeared in the *Reader's Guide* for 1955-57 and 30 articles appeared in the 1959-61 period.) The problem of nuclear fallout and of the storage of other military wastes were the foci of attention. It was in 1957, too, that the National Academy of Sciences, through a special report, drew attention to the radioactive waste problem.¹⁹ From 1963 to 1970, however, radioactive waste received little attention in press sources (approximately four articles were noted in the *Guide* in that period). As a consequence, the period which we reviewed marks, we think, the re-emergence of the issue in the media.

There are a number of related explanations for its re-emergence. By the 1970's, the variety of national issues which dominated the press in the 60's had diminished (e.g., Viet Nam and civil rights), and the opportunities for discussion of other policy issues increased. One of the policy issues to

Table 1. Number of articles by year and source

	1973-74	1975-76	1977-78	Total
National Press	12	33	77	122
General Scientific	13	16	41	70
Nuclear Scientific	40	86	92	218
Nuclear Industry/ Utility	7	33	39	79
Environmental	11	37	54	102
Local Press	0	32	203	235
Local	83	237	506	826

receive more attention was the nation's commitment to the commercial nuclear power industry. When radioactive waste was identified by key participants in the emerging public debate as a major problem which could impede commercial nuclear power development, the issue became increasingly newsworthy.²⁰ Thus, as discussions and controversy over nuclear power intensified, more articles on radioactive waste appeared.

The growth of public information has also coincided with increased policy and research activity in radioactive waste management. This activity was necessitated not only by the existence of radioactive waste from our military commitment to nuclear weapons, but by the blossoming of the commercial nuclear reactor industry and the plans to reprocess spent fuel from this industry. In December of 1970 there were 19 operating reactors. Five years later there were 54 operating reactors.²¹ By 1974, commercial radioactive waste was a reality. Because the industry was commercial and because it was also subject to increasing governmental regulations, the attention given to management and regulation was subject to public scrutiny and media coverage. This right of public scrutiny is in sharp contrast to the conditions under which military and experimental reactor work is handled.

The commitment which the Federal government made in the late 60's and early 70's to public involvement in policy formation also contributed to the emergence of the issue in the media. The actions which the government took to find a suitable site for a radioactive waste repository resulted, for example, in considerable interaction between Federal representatives, state, and in some instances, the local publics. This interaction brought local public attention to radioactive waste policy efforts and contributed to the emergence of the issue in the national press.

Finally, attention to radioactive waste problems was reinforced by growing public attention to a variety of environmental issues and to the growth of the environmental movement.²² As another form of possible pollution, radioactive waste had the interest and attention of the environmental movement and its supporters. This attention resulted in increased publicity.

Will the flow of information persist? Anthony Downs postulates that there exists a five-stage issue attention cycle for environmental issues.²³ Stage One, or the pre-problem stage, prevails "when some highly undesirable

social condition exists, but has not yet captured much public attention, even though some experts of interest groups may already be alarmed by it." The radioactive waste issue is past this stage. In Stage Two, as a result of some dramatic events, the public becomes aware of and alarmed by the problem. This awareness is facilitated by increased media attention. In this stage there is general acceptance of the notion that the problem can be solved. Stage Three occurs when the public gradually realizes that there is some cost to "solving" the problem. Stage Four occurs when there is a gradual decline in public interest as a result of individuals becoming bored or overwhelmed by the difficulties of solving the problem. In the final stage, or post-problem stage, the issue has been replaced at the center of public concern and "moves into prolonged limbo -- a twilight realm of lesser attention or spasmodic recurrences of interest."

Assuming that such a cycle exists, then the data indicate that the radioactive waste issue, as it is addressed in the 1970's, is still on the "up" side of the cycle. Moreover, because the waste problem is periodically redefined or refocused as it was after, for example, the decision to postpone reprocessing, we suspect that media attention will persist for quite some time, or until there is resolution of major radioactive waste issues such as the storage of high level commercial waste.

IV. THE RADIOACTIVE WASTE POLICY PROBLEM AS REFLECTED IN THE PRINTED MEDIA

Of what importance is the increase in media attention? There are a number of possible effects. Certainly increased attention expands the audience to any conflicts which may arise over the issue, and in some instances may mobilize individuals to participate in these conflicts. Media attention may in addition create greater opposition to efforts to implement the technological dimensions of the policy. Finally, and this is the effect in which we are primarily interested: attention by the media to a specific issue not only tends to place the issue on the public's agenda for consideration but it also tends to structure how the problem is defined by recipients of that information. In this case, we assume that the attention which the different presses focus on the variety of issues and themes defines for the readers of these presses the problem of radioactive waste.

In this study 15 separate theme categories were identified: Existing disposal technology; Technology RD&D; Management; State and local government policies and decisions; Federal policies and decisions; Intergovernmental conflicts; International policies or issues; Procedures for formulating policies; Transportation; Theft/sabotage/security; Health hazards; Volume of waste/existence of waste; Economic costs of waste management; Public reaction; and Ethical issues. These categories were in turn organized into four broad categories which represented major underlying dimensions of the policy discussion: Technical; Institutional; Risk; and Social/Economic/Ethical. Table 2 presents the organization of these dimensions, describes the 15 thematic categories, notes what information was included in each thematic category and provides a sample of themes from the different press sources.²⁴ (See Section II for discussion of how themes were derived.)

The technical dimension included two thematic categories. Information which describes the existing technology for waste disposal as well as potential technical options is one category. Themes of this type included the technical merits and problems associated with existing waste disposal technologies. A dominant approach was that of geological disposal, and more specifically, disposal in salt deposits. Disposal in oceans was also mentioned and it was not unusual to find descriptions of technologies operating in foreign countries. Some questions were raised as to whether any of

Table 2. Theme categories

Categories	Definition	Press Summary Examples
<p><u>I. Technical Issues</u></p> <p>1. Existing disposal technology and/or technical options for radioactive waste disposal</p>	<p>Discussions of the technical merits and problems associated with existing waste disposal techniques and proposed disposal options</p>	<p>Performance of low level waste systems is not good (environmental)</p> <p>Scientists believe that huge cracks in the Eastern base of the Atlantic might be perfect as a waste disposal place for nuclear waste (national press)</p> <p>General approach to disposal of radioactive waste is deep burial (industry)</p> <p>The principal methods of human intrusion to underground storage would be through drilling or mining the salt (nuclear scientific)</p> <p>Two basic alternatives for disposing of radioactive waste: in geologic formations or to expel from the earth (general scientific)</p> <p>Professor explains how nuclear wastes would be handled and stored in salt domes</p>
<p>2. Technology RD & D</p>	<p>Discussions of experimental results on new technologies and the need for research</p>	<p>RD& D conducted so far provides inadequate information to design successful systems (environmental)</p> <p>Some technical problems still need solving (national press)</p> <p>Additional research needed to resolve problems related to medium selection and repository design (industry)</p> <p>Technology development for nuclear waste management is too slow: results are still years away (nuclear scientific)</p>

Table 2. Theme Categories (continued)

Categories	Definition	Press Summary Examples
		<p>Laser research to reduce amount of radioactive waste in reprocessing cycle (general scientific)</p> <p>Testing to see how hot cannisters of radioactive waste would affect walls of salt mine (local press)</p>
<p>II. Management, Regulation and Institutional Issues</p> <p>3. Management</p>	<p>Discussions of the success, failure, and/or requirements in the management of existing radioactive waste facilities and projects</p>	<p>Irresponsibility of industrial handling of radioactive waste (environmental)</p> <p>Federal nuclear waste management is a disaster area (national press)</p> <p>Fragmented radwaste management structure poses problems (industry)</p> <p>NRC should develop long-range waste management plan (nuclear scientific)</p> <p>Government made optimistic estimates of the time required to develop facilities (general scientific)</p> <p>No good track record with storage; many problems and leaks (local press)</p>
<p>4. State and local government policies and decisions</p>	<p>Discussions of an action, attitude, or policy of a state of local jurisdiction on radioactive waste</p>	<p>Michigan governor signs bill banning disposal and storage of wastes (environmental)</p> <p>Governor Carey (New York) said he is committed to ...seeking safer storage for radioactive wastes... (national press)</p>

Table 2. Theme Categories (continued)

Categories	Definition	Press Summary Examples
		<p>Minnesota forbids permanent storage of radioactive waste and transportation of wastes into the state (nuclear scientific)</p> <p>State requests right to veto (general scientific)</p> <p>Louisiana House Natural Resources Committee approved bill prohibiting the storage and disposal of nuclear wastes in Louisiana salt domes (local press)</p>
5. Federal policies and decisions	Discussions of an action, decision, or policy of the Federal government on radioactive waste	<p>ERDA surpassing the environmental concerns of government scientists over waste disposal (environmental)</p> <p>NRC must consider nuclear waste before licensing reactors (national press)</p> <p>ERDA's radioactive waste policy announced (industry)</p> <p>Draft Environmental Impact Statement for Hanford says waste management programs have minimal impact (nuclear scientific)</p> <p>DOE decided that Federal government should take over responsibility for storing spent fuel (general scientific)</p> <p>ERDA studying sites for possible burial of wastes (local press)</p>
6. Intergovernmental conflict	Discussions of existing or potential conflict among various levels of government or between various branches of government at the Federal level	AEC may store wastes where it has substantial payrolls such as Nevada, Idaho, or Washington (environmental)

Table 2. Theme categories (continued)

Categories	Definition	Press Summary Examples
		<p>New York City's ban on transporting radioactive waste intrudes illegally on the regulatory powers of the Federal government (national press)</p> <p>A conflict exists between NRC autonomy and military authority over radioactive waste (industry)</p> <p>ERDA waits for better relations with Michigan citizens before drilling for waste site (nuclear scientific)</p> <p>Editorial blasts ERDA's attitude. Michigan's concern over dump will be taken into account but state has no veto power (local press)</p> <p>Conflict between NRC authority and military authority (general scientific)</p>
7. International policies or issues	Reports of effects of international cooperation in waste management or of proposals to store foreign radioactive waste in U.S.	<p>U.S. will become dump for foreign nuclear wastes (environmental)</p> <p>Austria offered to help Iran with storage of its nuclear waste (national press)</p> <p>There is a need for an international agreement (industry)</p> <p>Need to develop and agree on internationally acceptable standards and criteria for handling and disposal of radioactive material (nuclear scientific)</p> <p>No uniform international approach to nuclear waste management exists (general scientific)</p>

Table 2. Theme categories (continued)

Categories	Definition	Press Summary Examples
8. Procedures for formulating policies	Discussions of problems with the procedures for formulating radioactive waste policy, particularly procedures for public involvement	<p>When researchers opinions conflict with official views, dissent is suppressed (environmental)</p> <p>Greater public understanding and action can change current policies (national press)</p> <p>NRC confounds decision-making by not issuing regulations (industry)</p> <p>EPA holds workshop in Albuquerque on policy and technical considerations for radioactive wastes and public acceptance of risks associated with wastes (nuclear scientific)</p>
<u>III. Health and Safety Risk</u> 9. Transportation	Descriptions of various methods for transporting waste and problems with methods; reports of transportation accidents, laws. Initiatives to regulate the transportation of radioactive waste	<p>Radioactive waste transport poses safety hazard to public (environmental)</p> <p>Laxity in transporting atomic wastes (national press)</p> <p>Spent fuel must be shipped safely (industry)</p> <p>Judge denies injunction against New York City's ban on transporting nuclear materials (nuclear scientific)</p> <p>Policy requires long distance transport of highly radioactive waste (general scientific)</p> <p>Transportation of wastes is an issue (local press)</p>

Table 2. Theme categories (continued)

Categories	Definition	Press Summary Examples
10. Theft, Sabotage, and Security	Discussions of theft, sabotage, and security problems in the handling of radioactive materials such as waste	<p>Nuclear theft could occur during transport and storage of waste (environmental)</p> <p>Safeguarding plutonium is an issue: Anti's say that the system is not adequate; Pro's point to safety record (national press)</p> <p>Easiest way for terrorists to get weapons is through theft of nuclear materials (nuclear scientific)</p>
11. Health hazards	Discussions which explicitly mention or imply health hazards related to radioactive wastes	<p>Maxey Flats is leaking - radioactivity is contaminating the air, soil and water (environmental)</p> <p>Massive pool of radioactive waste stored underground in upstate New York poses a threat to public health (national press)</p> <p>Most waste is harmful for only 200 years (industry)</p> <p>The potential for damage through accidental releases from non-reactor situations is at least equal to and maybe in excess of that at the reactor (nuclear scientific)</p> <p>Not enough safety precautions in handling of radioactive materials by untrained workers (general scientific)</p> <p>Waste could cause deaths, cancer, and birth defects (local press)</p>
12. Volume of waste; existence of waste	Discussions of the volume of waste which needs to be disposed of; or statements asserting the existence of radioactive waste and the need to find solutions to solve problems	<p>Large fuel accumulations and states are getting apprehensive (environmental)</p>

Table 2. Theme categories (continued)

Categories	Definition	Press Summary Examples
		<p>Rapidly accumulating wastes with no place for storage (national press)</p> <p>Amount of radioactive waste small, overall risk negligible (industry)</p> <p>Findings in <u>Science</u> say that commercial radioactive waste is insignificant compared to military nuclear wastes (nuclear scientific)</p> <p>There is no question that a disposal area will have to be selected (local press)</p> <p>Spent fuel piling up because no reprocessing (general scientific)</p>
<p>IV. Social/Economic/Ethical Issues</p> <p>13. Economic costs of waste management</p>	<p>Discussions of the financing of waste management programs, local costs of siting of building or operating facilities</p>	<p>Utilities should pay cost for radwaste disposal (environmental)</p> <p>No reliable cost estimates for ultimate disposal and perpetual care of radwastes (national press)</p> <p>Cost of nuclear waste disposal should not be a constraint in nuclear power development (industry)</p> <p>NFS shuts down reprocessing facility but has no solution for disposal of 600 tons of spent fuel or who will pay for solidification (nuclear scientific)</p> <p>Problems with New Mexico site (brine pocket discovered) will delay and increase cost of project (general scientific)</p>

Table 2. Theme categories (continued)

Categories	Definition	Press Summary Examples
		Louisiana not committed to radioactive waste storage until assured it will also get benefits (e.g., energy or economic activity) (local press)
14. Public Reaction	Reports of reactions to specific waste management policies and actions; and discussions which assert that public opposition is a problem	<p>Barnwell to build storage facility unless more citizen action (environmental)</p> <p>Forecast that people at Carlsbad, New Mexico will be hospitable to burial of waste (national press)</p> <p>There is a need for local public acceptance of radioactive waste policies (industry)</p> <p>Citizens organization opposes NY power plant saying plants are unsafe...and there is already 100 million gallons of wastes and nowhere to put them (nuclear scientific)</p> <p>There is opposition to storage of atomic wastes in underground salt domes (local press)</p>
15. Ethical Issues	Discussions of the burden to future generations of present radioactive waste policies; the potential threats to civil liberties; and the irreversibility of some nuclear discussions	<p>Safeguarding plutonium would infringe on private rights (environmental)</p> <p>Safeguards system could result in a garrison state (national press)</p> <p>Burden on progeny is an issue in radioactive waste disposal (industry)</p> <p>Problem of waste management is more a social, political and ethical challenge (nuclear scientific)</p> <p>Probable impact on future generations uncertain (general scientific)</p> <p>Commitment to future generations to deny disposal of wastes in state now (local government)</p>

these technologies were "ready," but most of the articles reported successes or failures of existing technology, or described those that were assumed to be ready. With the exception of some articles found in the nuclear scientific and general scientific presses, most discussions were quite general and lacking in technical specificity. Technology development issues was the second component of the technical dimension. Discussions were identified as falling in the technology development category if they dealt with experimental results of proposed technologies, discussed the specific research that is needed to make nuclear waste disposal feasible, or identified the general problem of the need for further research.

The management, regulation and institutional dimension included those thematic categories which discussed the role of different institutions in the policy process or which commented on the development or implementation of policies. The "management" category included discussions of the operation of waste facilities and/or projects, with value judgments regarding the success or failure of the management of these projects. "State and local policies and decisions" dealt mainly with state/local initiatives in support or opposition to siting waste facilities and were concentrated in the national and local press sources. The category "Federal governmental policies and decisions" included discussions of the actions at the national level on nuclear waste management. The bulk of these discussions included reports of Federal studies, announcements of policy discussions or of actions to implement policy. "Intergovernmental conflict" themes were those in which the central topic was the existing or potential conflict among various levels or branches of government. The category "International policy and issues" evolved from reports of European experiences in nuclear waste management or of proposals to store international waste in the United States. Themes which dealt with the way in which nuclear waste policies were formulated composed yet another category. The discussions in this category frequently raised the issue of the adequacy of existing arrangements for public input. How these themes were discussed did vary somewhat from one press source to another. In the scientific sources, the discussions reviewed were in most instances straightforward, factual reports, often not accompanied by editorial

comment. In the environmental sources nearly all of the discussions included in this broad dimension implied that there were problems with existing management or negligence by Federal authorities in dealing with the issue.

Another major underlying dimension of the radioactive waste problem related to the real or perceived health and safety risks resulting from the existence, transportation, and handling of nuclear waste material. Issues were included in this category if they were explicitly or implicitly concerned with health and safety risks. For example, transportation issues could be considered technical but were included in this thematic category because the underlying and frequently explicitly stated view was that the transportation of wastes involved risk. Issues in this category ranged from descriptions of methods and reliabilities of transportation to case histories of transportation accidents to state and local initiatives and laws designed to regulate the transportation of nuclear waste. Likewise, the theme category "volume of waste or the existence of waste" had an underlying concern with the health and safety risks of the continued buildup of waste materials awaiting final disposition. Discussions which fell into this category specifically drew attention to the volume of waste which presently needs to be disposed of or will need to be disposed of in the future. These articles were generally critical of current waste management policies, especially with the interim on-site storage regulations. Theft, sabotage and security themes were also considered components of the risk dimension. Discussions of risk also varied somewhat from source to source. In the environmental press and the national press the risk discussions were often linked to reports of leaks, accidents or to assertions that there is a considerable amount of waste to be disposed of. The scientific sources discussed risk in a relatively objective manner by defining the problem, and by utilizing when appropriate, scientific methods. The nuclear industry/utility sources discussed risk as a non-issue.

The fourth major underlying dimension dealt with social, economic and ethical themes. The economic costs of waste management programs were one theme category. The financing of a waste management program and local costs of siting, building and operating the facilities comprised the bulk of this category. Public reaction issues formed a second issue category. Reports of reactions to specific waste management

policies and actions are included as well as discussions which assert that public opposition is a problem or concern, and should be addressed at some point in the policy process. The final theme dealt generally with ethical issues. This category included the burdens to future generations, the potential threats to civil liberties, and the irreversibility of some nuclear waste policy decisions.

Results

The distribution of issues among the 15 theme categories and summarized for the broad issue categories is presented in Table 3 for each of the specialized and nonspecialized information sources for the 1973-1978 period.

The data indicated that for all sources, discussions of radioactive waste have focused more frequently on themes not directly related to the technical problems of radioactive waste storage or isolation.

Information on the activities of different levels of government and of problems related to these activities (e.g., management) makes up from 28.2% (environmental) to 41.0% (local press) of the topics discussed in the articles reviewed. In addition, discussions of risks to the public or environment from the existence of the waste, the transporting of wastes or the disposing of wastes receive considerable attention, particularly in the environmental press (39.5%) as might be expected, and in the national press (35.7%). Even in the scientific sources, however, risk themes are discussed relatively frequently: more than technical themes for the general scientific; and slightly less than technical themes for the nuclear scientific sources.

The social, economic and ethical themes as a group receive relatively less attention for all sources with the exception of the local press and the environmental press. Individually, the themes of economic costs and "public reaction" receive a moderate amount of attention relative to the other 13 theme categories. And in the case of the local press, the number of articles which discuss "public reaction" stands out as a comparatively major theme. Only ethical issues rank low for all sources and relative to the other theme categories.

Table 3. Percentage distribution of themes by source, 1973-1978

	National press	General scientific	Nuclear industry/ utility	Nuclear scientific	Environmental	Local
	% (Frq)	% (Frq)	% (Frq)	% (Frq)	% (Frq)	% (Frq)
Technical	17.3 (45)	26.6 (45)	31.4 (42)	27.0 (93)	13.9 (27)	16.4 (86)
Existing disposal technology	14.6 (38)	21.3 (36)	24.6 (33)	20.9 (72)	9.2 (18)	10.8 (57)
Technology RD & D	2.7 (7)	5.3 (9)	6.7 (9)	6.1 (21)	4.6 (9)	5.5 (29)
Institutional	31.9 (83)	29.0 (49)	34.3 (46)	36.9 (127)	28.2 (55)	41.0 (216)
Management	5.8 (15)	8.9 (15)	9.0 (12)	5.8 (20)	7.2 (14)	4.7 (25)
State and local government policies and decisions	8.8 (23)	2.4 (4)	3.0 (4)	5.2 (18)	3.6 (7)	15.2 (80)
Federal policies and decisions	8.1 (21)	10.7 (18)	14.9 (20)	15.4 (53)	8.7 (17)	17.3 (91)
Intergovernmental conflicts	4.2 (11)	2.4 (4)	2.2 (3)	4.4 (15)	3.1 (6)	3.2 (17)
International policy or issues	4.2 (11)	3.6 (6)	1.5 (2)	3.8 (13)	1.5 (3)	0.2 (1)
Procedures for formulating policies	0.8 (2)	1.2 (2)	3.7 (5)	2.3 (8)	4.1 (8)	0.4 (2)
Risk	35.7 (93)	30.2 (51)	26.1 (35)	25.3 (87)	39.5 (77)	20.1 (106)
Transportation	6.5 (17)	3.6 (6)	2.2 (3)	3.5 (12)	4.6 (9)	0.9 (5)
Theft/sabotage/security	2.7 (7)	3.0 (5)	0.7 (1)	4.1 (14)	4.1 (8)	0.2 (1)
Health hazards	15.0 (39)	12.4 (21)	13.4 (18)	12.2 (42)	20.5 (40)	15.0 (79)
Volume of waste; existence of waste	11.5 (30)	11.2 (19)	9.7 (13)	5.5 (19)	10.3 (20)	4.0 (21)
Social	15.0 (39)	14.2 (24)	8.2 (11)	10.8 (37)	18.5 (36)	22.6 (119)
Economic costs of waste manage- ment	6.2 (16)	5.3 (9)	3.7 (5)	3.8 (13)	6.7 (13)	4.2 (22)
Public reaction	7.7 (20)	5.9 (10)	3.7 (5)	4.9 (17)	9.2 (18)	17.1 (90)
Ethical issues	1.2 (3)	3.0 (5)	0.7 (1)	2.0 (7)	2.6 (5)	1.3 (7)

 $\chi^2 = 270.78$

df = 70

p<0.001

The Dominance of Non-Technical Themes

The distribution of themes among the broad theme categories appears to reinforce the view of many observers that non-technical issues in the debate over radioactive waste management are as important as, if not more important than, technical issues. What is most interesting from our perspective, however, is that information on the non-technical issues of the problem not only is prevalent in the national press or the environmental press, but also in the general scientific and the nuclear scientific. Certainly this finding suggests that there is a broad spectrum of the public which includes environmentalists, scientists, and "the person on the street" who will identify and define as important a variety of non-technical issues in the resolution of the radioactive waste problem.

This view is reinforced on closer reading of the individual articles. Discussions in the general scientific and nuclear scientific articles are not simply reports that the lay public is concerned about these issues. They are in many instances part of a continuing debate within the various journals over specific dimensions of the waste problem.

Risk Themes

Another expected finding is the relative frequency with which risk themes are discussed. Many students of the nuclear power conflict have asserted that perceived risk is a major factor creating opposition to the technology.²⁵ The data in Table 3 provide evidence that a substantial amount of the information available to a variety of segments of the public is composed of discussions of real or perceived risk related to the existence of radioactive waste and the methods for disposing of it. Again, while attention to these themes is found more frequently in the environmental press and the national press, the topic is also discussed frequently in the scientific sources and the nuclear industry/utility sources.

There are, of course, some differences between the sources in how the risk themes are presented. Reports in the national press, local press, and the environmental press tend to use provocative language which we suspect reinforces the concept of risk. Moreover, in the environmental and

national sources, the risk discussions are often linked to reports of leaks, accidents or to assertions that there is a considerable amount of waste to be disposed of. The reports of the existence and amount of waste are frequently overstated (e.g., vast quantities of radwaste exist and must be disposed of). The scientific sources discuss the risk problem in a relatively objective manner by defining the problem, bringing to bear any appropriate scientific measures to study the problem and by evaluating the methods and the findings. The tendency of the industry/utility sources is to provide information which denies the importance of the risk dimension in formulating the radioactive waste problem.

Institutional Themes

The substantial proportion of discussions with institutional themes reflects, we think, the realities of the policy context. Many governmental jurisdictions and agencies are potentially responsible for or affected by radioactive waste management policies. More importantly, a substantial amount of activity involving these institutions occurred during the period studied: policy alternatives were formally reviewed; a variety of public hearings, including Congressional hearings, were held; the former Office of Waste Isolation launched efforts in several states to site a radioactive waste repository; public controversies developed over the responsibility of the State of New York for the decommissioning of the West Valley reprocessing plant and of the State of Kentucky for the Maxey Flats low level waste facility.²⁶ That the press would ignore these would appear to be a flagrant abuse of their prerogative to select information to print. The effect of this attention, however, is to advertise the institutional issues or policy problems which are inherent in the development and implementation of any policy and to make these issues important in the public's perception of the problem.

Socio/Economic and Ethical Themes

The lack of attention to ethical issues such as the responsibility of this generation to future generations is another interesting finding. These issues have captured the imagination and attention of some scholars who

address the nuclear waste problem. They may indeed be very important considerations. However, one should not expect many in the attentive public to have thought much about them since so little attention has been given to these themes in the different presses.

The data also indicate that in all information sources, public reaction is an important but not a dominant, explicit theme in radioactive waste discussion. While opposition or support may not be explicitly mentioned in individual articles, however, the review of the specific discussion indicates that the existence of controversy is frequently implied.

V. PUBLIC INFORMATION OVER TIME ON THE TOPIC OF RADIOACTIVE WASTE

Has there been a change over time in the content of information on radioactive waste? Have themes emerged and become more or less important as events changed? The data have been divided according to the date of publication into three broad time periods: 1973-74, 1975-76 and 1977-78, which reflect three phases in the current policy debate. During the 1973-74 period radioactive waste was emerging as a policy issue visible to the public. By 1975 and into 1976 there was considerable discussion over the reprocessing of spent fuel as well as referendums in several states over nuclear power and waste issues. By 1977, most of the referendums had been held and President Carter had made his decision to postpone reprocessing.

Results

Tables 4, 5, 6, 7, and 8 review the distribution of issues for each press excluding local press for the three time periods and Table 9 summarizes these themes for all sources over time. Non-technical issues have for each period, and for each source with the exception of the nuclear scientific, represented a majority of the themes documented in the articles. There has, however, been a shift in the proportions in the theme categories which suggest the emergence and decline of some topics.

National Press — The three time periods suggest general changes in the content of information on radioactive waste (see Table 4). There was a major change in the proportion of institutional themes from 11.5% in 1973-74 to 40.4% in 1977-78. Four issues emerged during 1975-76 and 1977-78 to explain this change: "State and Local Policies and Decisions;" "Federal Policies and Decisions;" "Intergovernmental Conflicts" and "International Policies or Issues." In 1977-78 these four issues represented 36% of the total issues analyzed for the sample.

During the six year period there was a decline in the proportion of "risk" themes from 42.3% to 33.6%. "Theft/Sabotage/Security" declined from 7.7% in 1973-74 to 0.6% in 1977-78. "Health Hazards" issues declined

Table 4. Emergence of themes over time: National Press

	1973-74		1975-76		1977-78	
	(%)	(Frq)	(%)	(Frq)	(%)	(Frq)
Technical	15.4	(4)	21.9	(16)	15.5	(25)
Existing disposal technology	15.4	(4)	17.8	(13)	13.0	(21)
Technology RD & D	0.0	(0)	4.1	(3)	2.5	(4)
Institutional	11.5	(3)	20.5	(15)	40.4	(65)
Management	7.7	(2)	8.2	(6)	4.3	(7)
State and local government policies and decisions	0.0	(0)	1.4	(1)	13.7	(22)
Federal policies and decisions	0.0	(0)	4.1	(3)	11.2	(18)
Intergovernmental conflicts	0.0	(0)	0.0	(0)	6.8	(11)
International policy or issues	0.0	(0)	5.5	(4)	4.3	(7)
Procedures for formulating policies	3.8	(1)	1.4	(1)	0.0	(0)
Risk	42.3	(11)	38.3	(28)	33.6	(54)
Transportation	7.7	(2)	4.1	(3)	7.5	(12)
Theft/sabotage/security	7.7	(2)	5.5	(4)	0.6	(1)
Health hazards	19.2	(5)	21.9	(16)	11.2	(18)
Volume of waste; existence of waste	7.7	(2)	6.8	(5)	14.3	(23)
Social	30.8	(8)	19.2	(14)	10.6	(17)
Economic costs of waste management	11.5	(3)	6.8	(5)	5.0	(8)
Public reaction	19.2	(5)	8.2	(6)	5.6	(9)
Ethical issues	0.0	(0)	4.1	(3)	0.0	(0)

Table 5. Emergence of themes over time: General Scientific

	1973-74		1975-76		1977-78	
	(%)	(Frq)	(%)	(Frq)	(%)	(Frq)
Technical	33.4	(8)	29.5	(10)	24.3	(27)
Existing disposal technology	29.2	(7)	23.5	(8)	18.9	(21)
Technology RD & D	4.2	(1)	5.9	(2)	5.4	(6)
Institutional	25.0	(6)	26.5	(9)	30.6	(34)
Management	16.7	(4)	8.8	(3)	7.2	(8)
State and local government policies and decisions	0.0	(0)	0.0	(0)	3.6	(4)
Federal policies and decisions	8.3	(2)	8.8	(3)	11.7	(13)
Intergovernmental conflicts	0.0	(0)	2.9	(1)	2.7	(3)
International policy or issues	0.0	(0)	2.9	(1)	4.5	(5)
Procedures for formulating policies	0.0	(0)	2.9	(1)	0.9	(1)
Risk	37.5	(9)	32.3	(11)	27.9	(31)
Transportation	8.3	(2)	2.9	(1)	2.7	(3)
Theft/sabotage/security	4.2	(1)	5.9	(2)	1.8	(2)
Health hazards	20.8	(5)	11.8	(4)	10.8	(12)
Volume of waste; existence of waste	4.2	(1)	11.8	(4)	12.6	(14)
Social	4.2	(1)	11.8	(4)	17.1	(19)
Economic costs of waste management	4.2	(1)	5.9	(2)	5.4	(6)
Public reaction	0.0	(0)	5.9	(2)	7.2	(8)
Ethical issues	0.0	(0)	0.0	(0)	4.5	(5)

Table 6. Emergence of themes over time: Nuclear Scientific

	1973-74		1975-76		1977-78	
	(%)	(Frq)	(%)	(Frq)	(%)	(Frq)
Technical	30.2	(23)	21.8	(30)	30.7	(40)
Existing disposal technology	23.7	(18)	15.9	(22)	24.6	(32)
Technology RD & D	6.6	(5)	5.8	(8)	6.2	(8)
Institutional	25.0	(19)	37.0	(51)	43.8	(57)
Management	10.5	(8)	5.8	(8)	3.1	(4)
State and local government policies and decisions	0.0	(0)	5.1	(7)	8.5	(11)
Federal policies and decisions	3.9	(3)	16.7	(23)	20.8	(27)
Intergovernmental conflicts	2.6	(2)	3.6	(5)	6.2	(8)
International policy or issues	5.3	(4)	3.6	(5)	3.1	(4)
Procedures for formulating policies	2.6	(2)	2.2	(3)	2.3	(3)
Risk	36.6	(28)	26.8	(37)	17.0	(22)
Transportation	6.6	(5)	4.3	(6)	0.8	(1)
Theft/sabotage/security	6.6	(5)	5.1	(7)	1.5	(2)
Health hazards	21.1	(16)	11.6	(16)	7.7	(10)
Volume of waste; existence of waste	2.6	(2)	5.8	(8)	6.9	(9)
Social	7.9	(6)	14.5	(20)	8.5	(11)
Economic costs of waste management	2.6	(2)	5.8	(8)	2.3	(3)
Public reaction	3.9	(3)	6.5	(9)	3.8	(5)
Ethical issues	1.3	(1)	2.2	(3)	2.3	(3)

Table 7. Emergence of themes over time: Environmental

	1973-74		1975-76		1977-78	
	(%)	(Frq)	(%)	(Frq)	(%)	(Frq)
Technical	11.1	(2)	17.1	(12)	12.2	(13)
Existing disposal technology	11.1	(2)	12.9	(9)	6.5	(7)
Technology RD & D	0.0	(0)	4.3	(3)	5.6	(6)
Institutional	22.2	(4)	28.6	(20)	29.0	(31)
Management	5.6	(1)	7.1	(5)	7.5	(8)
State and local government policies and decisions	0.0	(0)	2.9	(2)	4.7	(5)
Federal policies and decisions	5.6	(1)	10.0	(7)	8.4	(9)
Intergovernmental conflicts	5.6	(1)	0.0	(0)	4.7	(5)
International policy or issues	5.6	(1)	2.9	(2)	0.0	(0)
Procedures for formulating policies	0.0	(0)	5.7	(4)	3.7	(4)
Risk	55.6	(10)	37.2	(26)	38.3	(41)
Transportation	5.6	(1)	2.9	(2)	5.6	(6)
Theft/sabotage/security	22.2	(4)	1.4	(1)	2.8	(3)
Health hazards	22.2	(4)	25.7	(18)	16.8	(18)
Volume of waste; existence of waste	5.6	(1)	7.1	(5)	13.1	(14)
Social	11.1	(2)	17.1	(12)	20.6	(22)
Economic costs of waste management	5.6	(1)	10.0	(7)	4.7	(5)
Public reaction	0.0	(0)	7.1	(5)	12.1	(13)
Ethical issues	5.6	(1)	0.0	(0)	3.7	(4)

Table 8. Emergence of themes over time: Nuclear Industry/Utility

	1973-74		1975-76		1977-78	
	(%)	(Frq)	(%)	(Frq)	(%)	(Frq)
Technical	50.0	(5)	24.2	(15)	35.5	(22)
Existing disposal technology	50.0	(5)	21.0	(13)	24.2	(15)
Technology RD & D	0.0	(0)	3.2	(2)	11.3	(7)
Institutional	20.0	(2)	40.3	(25)	30.6	(19)
Management	20.0	(2)	11.3	(7)	4.8	(3)
State and local government policies and decisions	0.0	(0)	0.0	(0)	6.5	(4)
Federal policies and decisions	0.0	(0)	19.4	(12)	12.9	(8)
Intergovernmental conflicts	0.0	(0)	1.6	(1)	3.2	(2)
International policy or issues	0.0	(0)	1.6	(1)	1.6	(1)
Procedures for formulating policies	0.0	(0)	6.5	(4)	1.6	(1)
Risk	30.0	(3)	24.2	(15)	26.4	(17)
Transportation	20.0	(2)	0.0	(0)	1.6	(1)
Theft/sabotage/security	0.0	(0)	0.0	(0)	1.6	(1)
Health hazards	10.0	(1)	16.1	(10)	11.3	(7)
Volume of waste; existence of waste	0.0	(0)	8.1	(5)	12.9	(8)
Social	0.0	(0)	11.3	(7)	6.5	(4)
Economic costs of waste management	0.0	(0)	4.8	(3)	3.2	(2)
Public reaction	0.0	(0)	4.8	(3)	3.2	(2)
Ethical issues	0.0	(0)	1.6	(1)	0.0	(0)

from 19.2% in 1973-74 to 11.2% in 1977-78. Only the "Volume/Existence of Waste" category increased from 7.7% in 1973-74 to 14.3% in 1977-78. The transportation category after declining in 1975-76 returned to the proportion it held in 1973-74.

Attention to social themes also declined substantially particularly with respect to information on public opposition.

General Scientific - The proportion of discussions dealing with technical themes has declined considerably from 33.4% in 1973-74 to 24.3% in 1977-78 (see Table 5). Institutional themes make up a slightly larger share of the sample in 1977-78 than previously, and social themes increased from 4.2% in 1973-74 to 17.1% in 1977-78. "Risk" themes have declined from a high of 37.5% in 1975-76 to 27.9% in 1977-78.

Several theme categories have emerged: "State and Local Policies and Decisions" and "Values" surfaced in 1977-78. "Intergovernmental Conflict," "Procedures for Formulating Policy," and "Public Reaction" each represent, for the first time, a small percentage in 1975-76.

There was a reduction in the proportion of themes dealing with "Transportation" from 8.3% in 1973-74 to 2.7% in 1977-78; and in the "Existing Technology" category from 29.2% in 1973-74 to 18.9% in 1977-78. The "Health Hazards" category also declined proportionately over the six year period from 20.8% to 10.8%. On the other hand, "Volume/Existence of Waste" increased proportionately from 4.2% in 1973-74 to 12.6% in 1977-78.

The Nuclear Scientific - As with the two previous press categories, institutional discussions have increased substantially relative to other topics on radioactive waste over the three periods reviewed (see Table 6). Risk themes declined over the three time periods. In contrast with either the "national press" sources and the "general scientific" sources, most of the 15 themes identified were discussed at least once in the 1973-74 sample. Only discussions of the "State and Local Policies and Decisions" were not included in this earlier period, and the "Ethics" category represented only 0.3% of the sample for the same period.

A number of themes have, however, changed in terms of proportional representation; "Transportation" has changed from 6.6% in 1973-74 to 0.8% in 1977-78; "Management" has declined from 10.5% to 3.5%; "Federal Policies and Decisions" has substantially increased from 3.9% to 20.8%; "Intergovernmental Conflict" issues have increased from 2.6% to 6.2%; "Theft/Sabotage/Security" declined from 6.6% to 1.5%; "Health Hazards" declined from 21.1% to 7.7%; and "Volume/Existence of Waste" increased from 2.6% to 6.9%. The "Economic Costs" category, the "Public Reaction" category, and "Existing Technology" category fluctuated during the 1975-76 period but returned to approximately the same proportional representation in 1977-78 as they had in the 1973-74 period.

Environmental - Risk themes rank first in frequency discussed for all three time periods, although there has been a substantial proportional reduction from the first period (see Table 7). This finding is in contrast to the other three press categories reviewed where either "institutional" or "technological" themes ranked first. "Social" themes also share a much larger proportion of the total sample in each time period than they do for other sources reviewed. Moreover, the discussion of social themes has increased proportionately to 20.6% over the three time periods as the environmental press has focused more on the role of opposition and opposition tactics.

Several themes have emerged after the 1973-74 period. "RD & D effort" surfaced in the 1975-76 sample, as did "intergovernmental conflicts;" "procedures for formulating policies" and "public reaction." Other themes have changed in proportional representation. "Theft/Sabotage/Security" declined as did "Health Hazards." "Volume/Existence of Waste" increased, "Federal Policies and Decisions" increased, "International Policies or Issues" declined, "Existing Technology" declined. Other issues showed slight fluctuations during the 1975-76 period, but remained approximately the same proportions in the 1973-74 and 1977-78 period: economics is one such issue which rose to 10% in 1975-76.

The Nuclear Industry/Utility Sources — The sample for the 1973-74 period may be so small that the proportional distributions are misleading and comparison between the three time periods are made difficult (see Table 8). The size of the sample may reflect, however, a general lack of attention given to radioactive waste issues by industry/utility sources during this period. The sizes of the 1975-76 and 1977-78 sample do permit some comparisons and by 1975-76, there is more information on a broader variety of subjects than in the previous two years. Certainly a variety of additional themes appear to have received attention, i.e., "Federal Policies and Decisions;" "Procedures for Formulating Policy;" "Volume/Existence of Waste;" and "RD & D Effort." Of these, the "Federal Policies and Decisions" category was proportionately quite high — 19.4% in the 1975-76 period.

The distribution of issues among the broad categories is quite similar to that observed for other sources by the 1977-78 period, although there are some differences in magnitude. Technical themes at 35.5% are more represented, followed by institutional themes (30.6%); risk themes (26.4%) and social, economic or ethical themes (6.5%).

The Significance of Changes in the Content of Information

The data suggest for all sources, with the exception of the nuclear industry/utility, discussions which address the institutional dimensions of the policy problem have increased relative to all other themes and that risk discussions relative to other themes have declined. There is no denying that by 1977-78 there was relatively more information on institutional dimensions of the waste problem. What the proportions hide over the three time periods is the fact that the total amount of information available to the public in all dimensions of the problem has also increased (see Table 9). The significance of this observation is that while relative to other themes the probability that members of the reading public receive information on risk themes has decreased in 1977-78, overall, the probability that someone would be exposed to a discussion of

Table 9. Emergence of themes over time/all sources

	1973-74		1975-76		1977-78	
	(%)	(Frq)	(%)	(Frq)	(%)	(Frq)
Technical	27.3	(42)	22	(83)	22.3	(127)
Existing disposal technology	23.4	(36)	17.2	(65)	16.8	(96)
Technology RD & D	3.9	(6)	4.8	(18)	5.4	(31)
Institutional	22.0	(34)	32	(120)	36	(206)
Management	11.0	(17)	7.7	(29)	5.3	(30)
State and local government policies and decisions	0.0	(0)	2.7	(10)	8.1	(46)
Federal policies and decisions	3.9	(6)	12.7	(48)	13.1	(75)
Intergovernmental conflicts	1.9	(3)	1.9	(7)	5.1	(29)
International policy or issues	3.2	(5)	3.4	(13)	3.0	(17)
Procedures for formulating policies	1.9	(3)	3.4	(13)	1.6	(9)
Risk	39.6	(61)	31.1	(117)	28.9	(165)
Transportation	7.8	(12)	3.2	(12)	4.0	(23)
Theft/sabotage/security	7.8	(12)	3.7	(14)	1.6	(9)
Health hazards	20.1	(31)	17.1	(64)	11.4	(65)
Volume of waste; existence of waste	3.9	(6)	7.2	(27)	11.9	(68)
Social	11.0	(17)	15.0	(57)	13.0	(73)
Economic costs of waste management	4.5	(7)	6.6	(25)	4.2	(24)
Public reaction	5.2	(8)	6.6	(25)	6.5	(37)
Ethical issues	1.3	(2)	1.9	(7)	2.1	(12)

risk by reading any specialized or general presses has increased. The nuclear scientific press provides the one exception. From 1973-1978, the relative proportion of risk articles declined as well as the absolute number.

The data also suggest that information in the different sources is responsive to changes in policy or in the policy situation. The theft, sabotage, security themes have declined considerably after the postponing of the decision to launch full scale reprocessing of nuclear fuel. The volume/existence of waste theme received more attention after this decision because spent fuel became identified as a waste product. Likewise, the overall increase in attention to institutional issues reflects, as noted before, the increase in institutional activity on the issue.

VI. COMPARISON BETWEEN SOURCES IN THE CONTENT INFORMATION ON RADIOACTIVE WASTE

The discussion to this point has focused on the similarities in the content of information on radioactive waste among sources and over time. We now turn to consider some of the differences between sources which might result in differences within the attentive public in defining the problem of radioactive waste management.

The nuclear industry sources seem least likely of all the presses to provide information on radioactive waste (see Table 8). These sources generally have the fewest number of articles and have in the past tended to concentrate upon the technical dimensions of the problem. By 1977-78 the number of articles had substantially increased, suggesting that for those people who rely on these sources for information, the radioactive waste problem is becoming important. Overall, however, the statistics point to a lack of concern with the radwaste problem. From a more subjective view, our reading of the articles also supports this view. The message which emerges from a considerable number of discussions is that radioactive waste is not an important policy issue; that it deserves any attention at all is because it is linked to the problem of public acceptance of nuclear power.

The nuclear scientific press has provided considerable information on the topic of radioactive waste. Its attention to the topic was clearly evident in the 1973-74 period and has continued through the 1977-78 period (see Table 6). This finding is not unexpected, and suggests that these presses have taken the lead in drawing the public's attention to radwaste issues. In comparison with the other press sources, the nuclear scientific press has been less inclined to discuss the radwaste problem in terms of its risk dimensions. Of all of the press sources, this press was the only one in which both the relative and absolute number of risk themes declined from the 1973-74 to 1977-78 period. Information on the institutional dimensions of the radwaste problem have, on the other hand, increased substantially, particularly information which focuses on the role of the Federal government. More than all the other sources, and this is substantiated by closer reading of each article, the nuclear scientific press transmits systematically and regularly reasonably objective information on the activities of those

institutions responsible for or potentially affected by radioactive waste policies. Finally, the nuclear press, not unexpectedly, give more attention than do other presses to the technical dimension of the radwaste problem. This attention has been sustained over the three time periods.

The environmental press is often considered, by those closely involved with radioactive waste management, the most deviant of the information sources on radioactive waste. Yet, the statistics demonstrate that in terms of the broad dimensions of the policy discussion this press "tracks" the other major sources (see Table 7). The differences which do exist are worth noting, however. Certainly discussions of risk are more prevalent relative to other discussions. Recently this press also appears to be giving more attention to discussions of public reaction.

While the environmental press may discuss similar dimensions of the radioactive waste problem as other presses, the information is not always presented in the same manner. Certainly for the environmental press and in comparison with either the nuclear scientific or the general scientific presses, the discussions of waste are more likely to be provocative in tone: the problem of the existence of radioactive waste is "vast;" the issuing of an environmental impact statement is "late;" the health risks potentially affect "millions."

In its early discussions of radioactive waste, the general scientific press focused on technical issues. While this press does not appear to have initiated much of the information in the different dimensions of the radioactive waste problem, over the years the information presented has touched on the broad spectrum of themes identified in this study (see Table 5).

The national press discussions of radioactive waste are distinguished from the other presses because of the early attention given to social themes, particularly public opposition. In contrast to other presses, this press also has given approximately equal attention to information on the State and Local Policies and Decisions and to the Federal Policies and Decisions. As with the environmental press, information on radioactive waste is sometimes presented in a provocative manner. Several headlines from the bibliography suggest the problem: "Riddled with Isotopes;" the "Deadly Dilemma of Nuclear Wastes;" "A Graveyard for Nuclear Wastes."

The local press in this study can be distinguished from the other sources because, as noted earlier, the articles used in the study came from newspapers in Louisiana and Michigan in 1976 and 1977. It was during this time that controversies in each state arose over the research activities of the Office of Waste Isolation, and the information presented in these articles helped to structure or define for those local citizens the major issues of these controversies. The heavy concentration of discussions which deal with the activities and policies of state government and of dealing with public reaction is different from that which was found for the non-local sources.

These findings are not totally unexpected. The concentration of issues in "public reaction" category and in the "state and local policies" categories represent certain realities of the situation in both states at that time. Public opposition to the research efforts did develop and was newsworthy. Moreover, state officials, including the governors offices, and the legislatures were actively involved in defining who could legally do what with respect to radioactive waste within the states (the issue of State's Rights quickly emerged) and in finding out what the real intentions of the Federal government were. These officials in most cases were willing to supply information to the press.

The effect of this publicity, however, may have been to divert the local public's attention from consideration of other dimensions of the controversy. One interesting finding which may temper this conclusion is the large number of articles which were published in each state. The considerable amount of information available increased the probability of any dimension of the problem coming to the public's attention. Finally, as with the national press, headlines for the articles were often provocative. The frequency with which the proposed site for a radioactive waste repository was called "dump" is perhaps the most striking example.

In conclusion, different configurations of information and different amounts of information to their constituents over time are apparent, suggesting that groups within the public may emphasize different dimensions of the radioactive waste problem in policy discussions. The most divergent group, we suggest, is the nuclear industry/utility. On the other hand, the dominance of themes which touch on a variety of nontechnical issues for all

sources point to a broader consensus on the need to address these themes in the policy controversy.

VII. A NOTE ON THE QUALITY OF TECHNICAL INFORMATION AVAILABLE TO THE PUBLIC

Nuclear waste and its management begins as a technical problem. The technical issues surrounding this problem by themselves require important policy decisions. They are, however, also linked to a variety of social, political, economic and environmental issues. The decision to store spent fuel on an interim basis or to dispose of the spent fuel rods permanently, has, for example, implications not only for the kind of storage techniques to be used but also for the future role of nuclear power in electricity generation, for the institutional controls necessary for management of the waste and for public acceptance.

As a consequence of this relationship, technical information is an important part of understanding the nontechnical issues of nuclear waste management. The study has demonstrated, however, that relative to other dimensions of the policy problem, technical information is provided less frequently. This conclusion is particularly true for the national press, the local press, and the environmental press. Moreover the discussions which we reviewed varied considerably in terms of quality and depth of analysis.

In order to draw some conclusions as to whether the information provided by the different presses facilitates public understanding of the relationships between the basic technical problems of waste management to the variety of nontechnical discussions, we looked at all the articles to determine whether or not they define or distinguish the form (or forms) of waste being discussed (e.g., high level, commercial, low level).

In this study the percentage of articles from all sources which defined the form of radioactive waste being discussed was 50.4% (see Table 10). Between sources, the local press articles stand out as having the smallest proportion (13.2%) of articles which defined the form of radioactive waste. National press articles also have a comparatively low percentage (45.9%). The more specialized sources are, on the other hand, more likely to define waste: 63.7% for environmental; 66.5%, nuclear scientific; 75.9%, nuclear industry; 84.3%, general scientific. The finding that the more specialized sources are more likely to define the form of radioactive waste being

Table 10. Radioactive waste defined by source

	Define waste				Total
	Yes		No		
	(%)	(Frq)	(%)	(Frq)	
National press	45.9	(56)	54.1	(66)	122
General scientific	84.3	(59)	15.7	(11)	70
Nuclear scientific	66.5	(145)	33.5	(73)	218
Nuclear industry/ utility	75.9	(60)	24.1	(19)	79
Local press	13.2	(31)	86.8	(204)	235
Environmental	63.7	(65)	36.3	(37)	102
Total	50.4	(416)	49.6	(410)	826

discussed is not startling. The relatively small percentage of articles in the non-specialized sources, however (particularly the small percentage in the local press sources), points out a problem of communication which potentially affects public understanding of radioactive waste policies. Specifically, many people who rely on these national and local sources for much of their information on specific issues may have little or no basis on which to sort and clarify the diverse technical and nontechnical issues. This lack of information on the basic technical dimensions of the radioactive waste problem can be the basis for a multitude of misperceptions, misunderstandings and conflicts.

Of these articles that explain the form or forms of waste being discussed, most of which appear in the more specialized sources, high level waste and high level commercial waste are the most often mentioned categories. Combined with the comparatively small proportion of articles mentioning high level military wastes, discussions of some aspect of high level waste occurs approximately 50% of the time when a form of waste is mentioned.

In addition, since military high level waste makes up a good part of today's waste problem, the apparent lack of frequency with which high level defense waste is explicitly discussed suggests to the authors again that information which clarifies the various dimensions of the radioactive waste problem is not readily available to the non-scientific public.

On the other hand, the authors believe it is significant that of those articles in the non-specialized sources that define waste, "high level" waste does not dominate all discussions of the radwaste problem. The frequency with which spent fuel rods are discussed (many of the articles which appeared after the reprocessing decisions) suggests the responsiveness of the various presses to new waste issues. These discussions, coupled with the considerable number of articles which address issues of low level waste, suggest that for the specialized presses, the radwaste problem involves more than high level, commercial waste.

VIII. FINAL OBSERVATIONS

It has been over 35 years since the first radioactive waste management policies were implemented and 25 years since the call by scientists for more research and for the revisions of past radioactive waste management policies.²⁷ Media attention during this period has been sporadic. The issue of radioactive waste appears to have first received major attention during the debates over atmospheric testing. The period from 1973 to 1978 marks, we think, the re-emergence of media attention to the issue.

Of what importance to the policy process and to the problem of public acceptance is this attention? This study has explored the effect which this attention may have on how individuals within the public define the policy problem. There are other consequences, however, which deserve some attention.

Mazur has suggested that media attention to controversies surrounding policies related to a specific technology tends to focus on the opposition and as a consequence creates more opposition within the public.²⁸ While for some sources at certain times public reactions have been given considerable attention relative to other issues (e.g., the National Press in the 1973-74 period, the environmentalists in the 1977-78 period and the local press during specific local controversies), the attention has never appeared to have dominated discussions. Most of the discussions of specific dimensions of the problem implied that there was controversy at least over the particular theme being discussed. Public opposition if it indeed increases as a consequence of media attention, may be as much a result of differences over issues as it is a function of publicity to the opposition.

Another effect of media attention is to increase the audience to the policy process. In the case of radioactive waste, media attention has created a national audience to radioactive waste policy discussions; to efforts at implementing existing waste management policies; and to the failures and successes of existing management efforts. Moreover, expanding the audience frequently leads to redefining and broadening the scope of the problem and this often creates more controversy.²⁹

Several characteristics with respect to the content of information on radioactive waste suggest that the scope of the problem has been broadened. First, the number of issues related to the general topic on which the public

is receiving information is considerable. As a consequence the activist, the decision maker, the affected citizen has more opportunity to gain support by appealing to the sentiments or interests of the public on any one of the subissues. Second, if the attention given to the topic of radioactive waste was related exclusively to technical themes, the impact of an expanded audience, we suggest, would be minimal. Most of us would remain uninvolved, allowing the decisions on the technical issues to be made by those more knowledgeable. But the results of this analysis suggest that the discussions of radioactive waste include a wide variety of non-technical issues which are broader in scope. More significantly, non-technical issues have received relatively more attention, specifically "institutional" and "risk" themes.

Third, the scope of the problem is defined diversely and broadly by the spectrum of information sources. The effect of expanding the scope of the problem is to expand the perceived impact of any decision or policy. As a consequence, new actors become involved and new decision arenas become relevant.

The efforts of OWI to conduct experiments on the suitability of various salt formations for the isolation of high level radioactive waste are, we think, examples of this phenomenon. State politicians, sensitive to the expanded audience to the efforts of the Federal government to conduct research, raised issues and questions which they perceived as reflecting the interests of their constituencies and of the national audience. In doing so they frequently redefined the problem and broadened its scope. For example, the safety and health of the local population during the period in which the experiments were to be conducted was translated into the question of States' Rights or the risks of nuclear power. In addition, these same politicians, seeking leverage in the decision-making process, introduced the problem in new decision arenas. State legislatures or the governor's office were requested to "take a stand," or to pass legislation. Finally the redefining of issues and expanding the scope of the conflict created more publicity which was then translated into "new information" on radioactive waste. The

results of this process were frequently frustrating to the policy-makers. What was thought of as a relatively simple policy task erupted into a complex and sometimes embarrassing controversy.

The above discussion suggests how the availability of public information on a policy topic compounds the task of defining and implementing policies. Public information is only one of a number of democratic practices, however, which makes policy making complicated. Committed to public involvement, the Federal government chooses to work with the States or a public utility like TVA to implement radioactive waste policies. This commitment also introduces new actors, raises new issues and generally confounds the resolution of the problem.

Lest one forget the obvious, expanding the audience to a debate, redefining the policy problem, introducing new actors, or shifting decision arenas can be beneficial steps in the evolution of a major policy. Certainly in radioactive waste this would appear to be the case. In the past 20 years, there has been considerable controversy between some members of the scientific community and Federal bureaucrats over the direction of radioactive waste research and the form of radioactive waste management policies. These controversies have revolved around a variety of technical issues. As controversies and decisions however, came increasingly under public scrutiny, new issues emerged reflecting broader social concerns. These new issues and the expanded audience to the policy discussions have frequently frustrated the decision-maker and made resolution of policy decisions more difficult. They have, at the same time, resulted in new efforts by scientists and bureaucrats to rethink the original technical problems, and have contributed to redefining the scope of the radioactive waste policy problem to include all forms of radioactive waste, as well as a variety of nontechnical concerns. They have resulted in new policies which, in the opinion of the authors, more accurately reflect the realities of the nuclear industry.

Finally, the focus of this study has been on the information available to the general public on the topic of radioactive waste. It described the kinds of topics that gain media attention over time and what types of sources focus on what kinds of issues. While not a measure of public opinion, the study has been a measure of the emergence of issues in public

printed discussions of radioactive waste. As such, it suggested those aspects of the policy problem on which the public may focus in the formation of public opinion. The study is limited, however, in that it does not describe the intensity or the direction (pro or con) of the issues. In addition, the study is not a measure of the importance of issues, a priori. Those issues which receive the most coverage in printed discussions relative to other issues may or may not deserve the most attention in the development of a responsible public policy. How important the issues are as defined by the printed sources depends to a great extent on the judgment of the policy analyst. He must determine if those issues which are discussed most frequently in the printed press reflect major dimensions of the policy problem.

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