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# Attitudes Toward and Perceptions of Pollution by Residents of the Big Stone Lake Area

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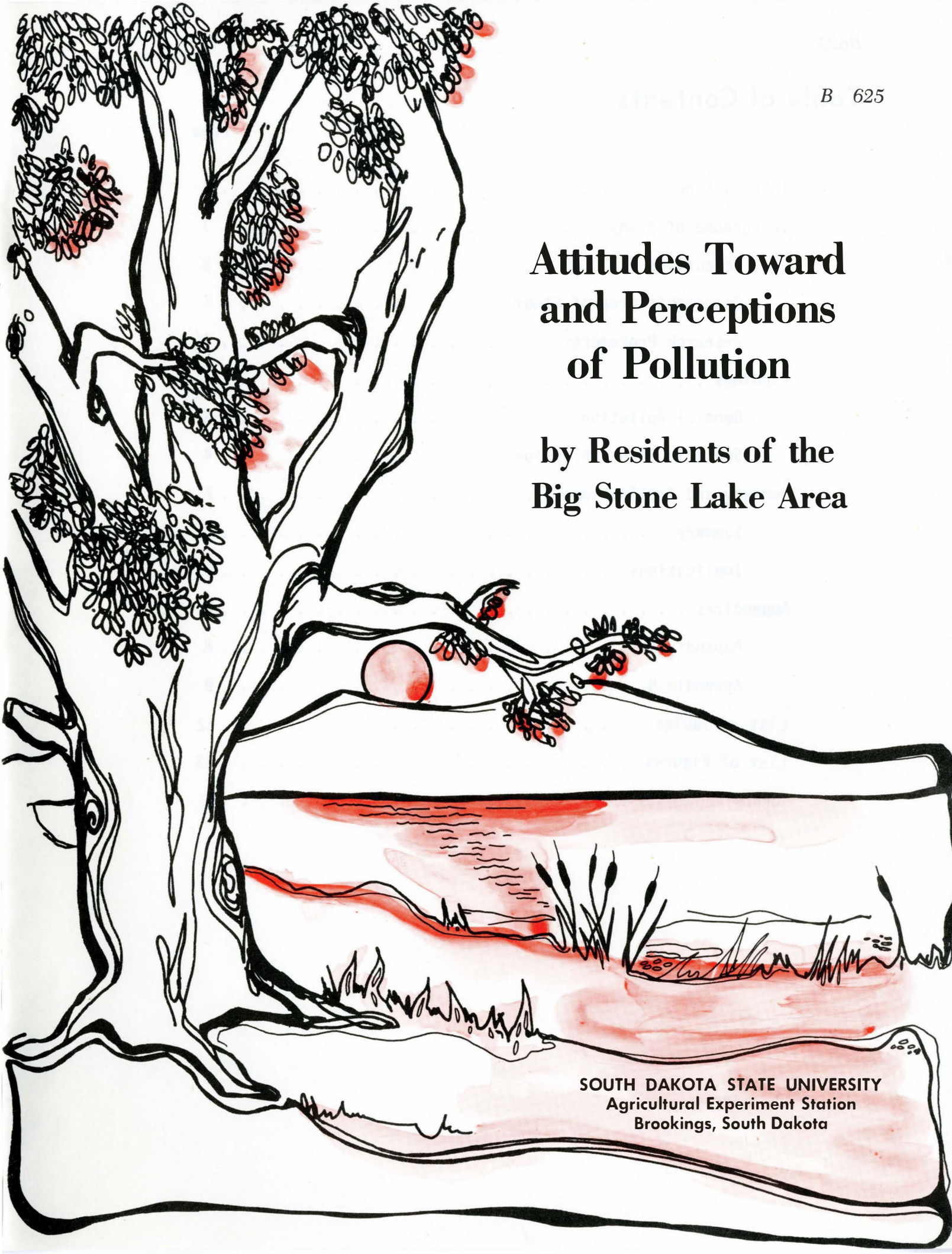
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# Attitudes Toward and Perceptions of Pollution

by Residents of the  
Big Stone Lake Area



SOUTH DAKOTA STATE UNIVERSITY  
Agricultural Experiment Station  
Brookings, South Dakota

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# Attitudes Toward and Perceptions of Pollution

## by Residents of the Big Stone Lake Area

By: Orville E. Lanham, Assistant Professor,  
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October, 1974

### Introduction

A recent trend in the United States has been the decentralization of industrial growth by establishing new plants in rural areas away from the traditional urban industrial complexes. Many rural areas have welcomed this industrialization as a means of broadening their tax base and providing new jobs.

Industrial development, however, has not always reduced the problems faced by many rural areas. The influx of new employees and their families has placed stress upon schools, churches and community utilities. Changes in community value structures have occurred as new job markets replaced previous sources of employment and challenged traditional values.

During a period of industrial decentralization, rural residents become exposed to those problems previously considered urban, including air and water pollution, and the disposal of large amounts of solid waste.

Coupled with this, during the 1960's there has been increased concern for the environment. This concern was fostered, in part, by the publishing of Rachel Carson's book, Silent Spring, which focused on the problem of residual pollution due to overuse of DDT.

In this decade, some groups such as the Sierra Clubs, which have long been involved with environmental problems, recruited many new members. Many new associations concerned with environmental problems were formed at both the local and national levels. Federal legislation created the Environmental Protection Agency to deal with these problems at the national level and most states established similar state agencies. States also updated their laws dealing with quality of water and air.

Residents of rural communities face a dilemma. To industrialize will alleviate some community problems, but it also appears to introduce to the community the need for major adjustments, some of which are pertinent to the contemporary environmental issues.

### Background of Study

South Dakota provides an interesting arena to study how residents adjust to industrial development and perceive environmental problems. Over half of the state's residents, twice the national average, live in rural areas. Ninety percent of the 307 incorporated communities in the state have less than 2,500 people, and 55 of the 67 counties list agriculture as the major industry. Only two counties, both with large metropolitan areas, have any extensive industrial development.

During the fall of 1969, a power consortium purchased a 2,800 acre tract of land near Big Stone City, South Dakota, for the construction of a 450 megawatt power plant. The construction phase of the plant was to start in 1972, with plant completion in 1975. The construction of such a generating facility will probably have an impact upon the residents of the three communities in the area, as well as farmers in the surrounding townships. The three communities were Big Stone City and Milbank, South Dakota, and Ortonville, Minnesota.

## Objectives

The objectives of the study were to determine:

- (1) the attitudes of local residents toward environmental problems; and,
- (2) whether these attitudes differ when the effects of selected socio-demographic characteristics such as age, education, and income are statistically controlled in the analysis.

## Geographic Area of the Study

In addition to the three communities previously indicated, the geographic area selected for this study included six townships in South Dakota adjacent to the lake: Alban and Big Stone in Grant County; and Geneseo, Lockwood, Becker and Lake in Roberts County.

Milbank and Ortonville had slight population increases in the 1960-1970 decade, but Big Stone City experienced a 12 percent loss in population. In terms of outmigration, Riley and Wagner indicated that the outmigration of people from 1960 to 1970 for Grant County was 17 percent of the 1960 population.<sup>1</sup> Five of the six townships registered losses in population (see Appendix B, Table B-1).

The area is heavily dependent upon agriculture as a major industry. Six percent of the labor force in the United States was engaged in agriculture, but almost half of the labor force in the study area was agriculturally employed (Appendix B, Table B-2). The number of farms in the study area declined in the 1964-1969 period.

Big Stone County, Minnesota, had a 19 percent loss in the number of farms, and Grant and Roberts Counties had losses of 10 percent each (Appendix B, Table B-3). In addition to agriculture, other smaller industries in the area include: two cheese factories, an insurance company headquarters office, granite quarries, a meat packing plant, a canning factory and a light metal fabricating plant. A steam electrical generating plant is located at the south end of Big Stone Lake adjacent to Ortonville.

## Research Procedures

A sample of 180 persons was randomly selected from the residents of the three communities adjacent to Big Stone Lake (Big Stone City, Ortonville and Milbank) and from the farm population in the surrounding townships. The respondents were personally interviewed in the fall of 1970. The interviewing yielded 144 completed schedules. Some respondents did not answer all of the questions and these incomplete schedules were eliminated from the analysis.

The interview instrument was designed to determine the perception and knowledge of residents about local and state pollution problems, as well as provide some information about the personal characteristics of the respondents.

<sup>1</sup>Riley, Marvin P. and Robert T. Wagner, "South Dakota Population and Net Migration, 1960-1970, Bulletin 58, February, 1971, Agricultural Experiment Station, South Dakota State University, Brookings, South Dakota.

Statistical procedures were used to determine the relationship between attitudes toward pollution problems and the following socio-demographic factors: age, education, length of residence, farm or urban residence, occupation, income, social participation, communication sources and participation in indoor or outdoor recreational activities.

These variables were selected in order to compare the results of this study with previous research findings, which state that persons most concerned with pollution problems were those with more education, higher incomes, younger in age than the average for the people in the area and having higher rates of interaction with others.

Eleven statements were used in this study to measure attitudes toward the environment. Agreement with the attitudinal statements indicated an awareness of environmental problems in the Big Stone Lake area.

Indexes were developed to measure two dimensions of the pollution problem. One index consisting of four attitudinal statements measured respondents' perceptions of pollution problems in general. The other index, composed of seven statements, measured respondents' perceptions of pollution specifically related to the anticipated operation of the power plant in the area.

A multiple variable analysis was used to assess the association between the 14 socio-demographic variables and the two pollution indexes. This analysis also assessed the ability of these variables to explain and/or predict attitudes toward pollution.

## Findings

### General Pollution

The general pollution index was comprised of four attitudinal statements related to perception of a general pollution problem in the area.

They were:

- (1) At present we have a potentially serious water pollution problem.
- (2) Air pollution is a problem in this area.
- (3) Thermal pollution might threaten the quality of the environment.
- (4) Industrial pollution has long threatened the quality of the environment.

Responses to the attitudinal statements varied (see Figures 1 thru 4). Nineteen percent of the respondents agreed that water pollution was a problem in the area. Fifty-eight percent agreed that air pollution was a problem. Approximately one-eighth of the respondents were undecided about whether air and water pollution were area problems. Almost twice as many persons agreed that industrial pollution might threaten the quality of the environment, compared with those who agreed that thermal pollution was a threat to the environment. More respondents were undecided about thermal pollution.

Figures 1 through 4

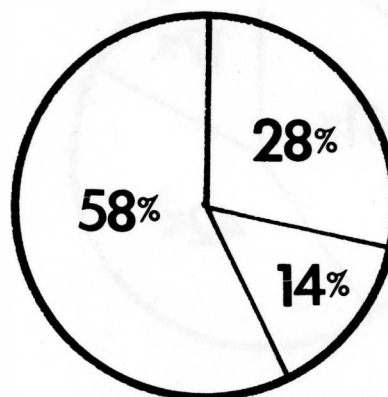


Figure 1 -- Air pollution is a problem in this area: agree 58%, undecided 14%, disagree 28%.

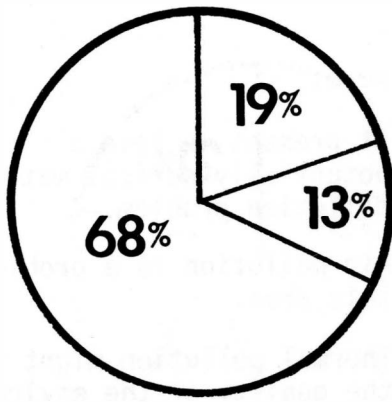


Figure 2 -- At present time we have a serious water pollution problem: agree 19%, undecided 13%, disagree 68%.

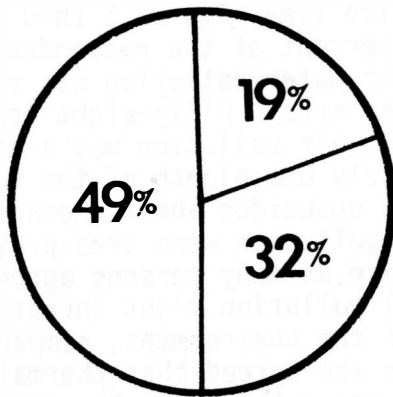


Figure 3 -- Industrial pollution has long threatened the quality of the environment: agree 32%, undecided 19%, disagree 49%.

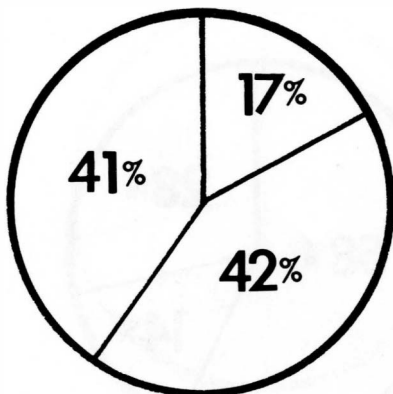


Figure 4 - Thermal pollution is a definite factor which might reduce the quality of the environment: agree 17%, undecided 42%, disagree 41%.

The findings were further analyzed to observe differences in the attitudes of the respondents when their place of residence was taken into account (see Table 1). Over half (58 percent) of the respondents were undecided about the existence of a pollution problem in the area, and slightly more than one-fourth felt there was no area pollution problem. Over one-fourth of the farmers (28 percent) agreed that there was a pollution problem in the area, whereas three-fourths of the Milbank residents seemed undecided about the general pollution problem.

Results of the multiple variable analysis indicated that three variables helped explain differences in the perceptions of general pollution problems. These were residence, income and occupation. Residential differences observed in Table 1 were significant.

Rural residents indicated greater perception of general pollution problems than did residents of the towns and villages. Blue collar workers, service workers and higher income persons were not as perceptive of the existence of a general pollution problem. This may be due to the rural residents' more direct involvement with, and greater dependence upon the natural environment.

### Specific Plant Pollution

Seven attitudinal statements constituted an index measuring perceived pollution related to the future operation of the power plant in the Big Stone area.

The seven statements were:

- (1) Air pollution would be a major problem after the plant's completion.
- (2) The power plant will damage the Big Stone Lake,
- (3) The South Dakota side of Big Stone Lake would be the most adversely affected by the plant's location.

- (4) The plant operation would seriously damage the quality of the environment.
- (5) The power plant would adversely affect recreational facilities in the area.
- (6) The plant operation will hurt the area's conservation practices.
- (7) The plant operation will hurt farm operation.

Responses differed according to the attitudinal statement (see Figures 5 thru 11). Forty percent of the respondents agreed that air pollution would become a major problem after the plant's completion. Forty-two percent agreed that the South Dakota side of Big Stone Lake would be the most adversely affected by the plant's location.

Figures 5 through 11

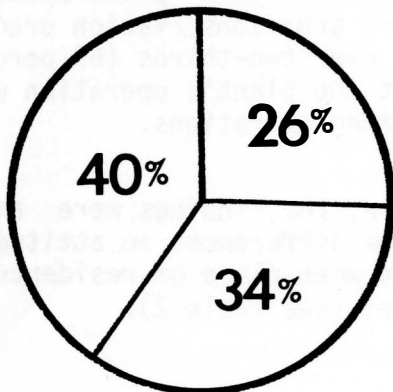


Figure 5 -- Air pollution would become a major problem after the plant is completed: agree 40%, undecided 26%, disagree 34%.

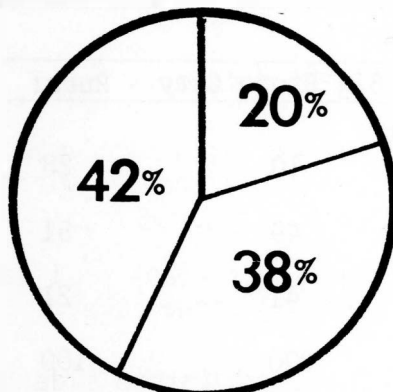


Figure 6 -- South Dakota side of Big Stone Lake would be the most adversely affected by the power plant's location: agree 42%, undecided 20%, disagree 38%.

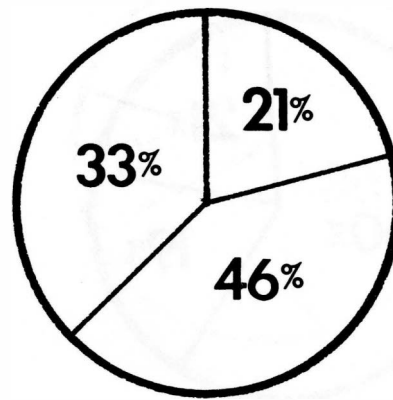


Figure 7 -- The power plant will damage the Big Stone Lake: agree 46%, undecided 33%, disagree 21%.

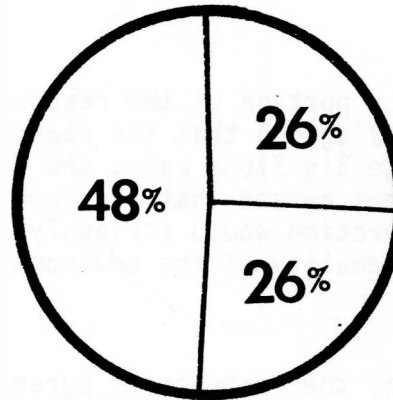


Figure 8 -- Power plant operation would seriously damage the quality of the environment: agree 48%, undecided 26%, disagree 26%.

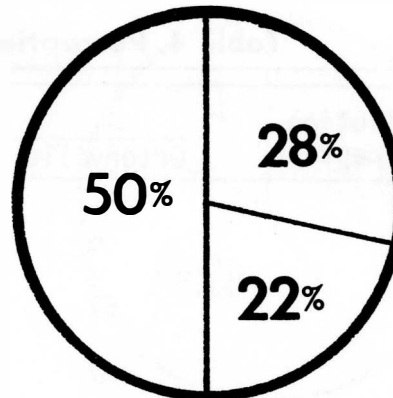


Figure 9 -- The power plant operation would adversely affect recreational facilities: agree 50%, undecided 28%, disagree 22%.



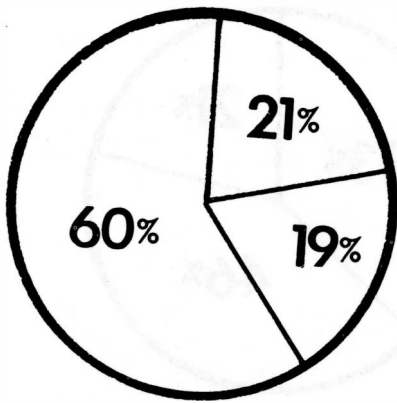


Figure 10 -- Power plant operation would hurt area conservation practices: agree 60%, undecided 21%, disagree 19%.

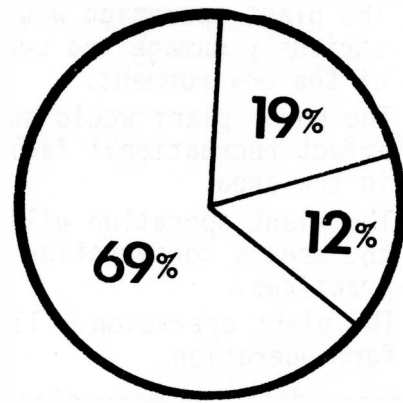


Figure 11 - Power plant operation would hurt farming operations: agree 69%, undecided 12%, disagree 19%.

A major portion of the respondents (46 percent) agreed that the power plant would damage Big Stone Lake, and forty-eight percent agreed that the power plant's operation would seriously damage the quality of the environment.

Three-fifths of the respondents agreed that the future power plant operation would hurt area conservation practices. Slightly over two-thirds (69 percent) felt that the plant's operation would hurt farming operations.

Half of the respondents agreed that the power plant would adversely affect recreational facilities in the area.

Again, the findings were analyzed to observe differences in attitudinal responses when place of residence was considered (see Table 2).

Table 1. Perception of a General Pollution Problem

General Pollution Problem Perception	Residence				Total
	Ortonville	Milbank	Big Stone City	Rural	
	Percent				
Agree	6	8	10	28	13
Undecided	57	78	49	51	58
Disagree	37	14	41	21	29
Total Percent	100	100	100	100	100
Number of Respondents	35	35	39	35	144

**Table 2. Perception of a Specific Plant Pollution Problem**

Plant Pollution Problem Perception	Residence				Total
	Ortonville	Milbank	Big Stone City	Rural	
	Percent				
Agree	46	82	48	32	51
Undecided	40	8	38	34	30
Disagree	14	14	14	34	19
Total Percent	100	100	100	100	100
Number of Respondents	35	35	39	35	144

Slightly more than half of the respondents (51 percent) agreed that the future plant operation would add additional pollution to the area. However, the percentage of farmers who agreed was less than for other residential categories. Eight out of every ten Milbank residents agreed that the plant operation would add pollution to the area.

The multiple variable analysis results indicated that two of the socio-demographic measures helped explain differences in perceived pollution problems related to the plant operation. These were residence and participation in area organizations. Residential differences observed in the above table were significant. The more organizations participated in by the respondent, the more the respondent was in agreement with the idea that the plant operation would add pollution to the area.

## Summary and Implications

### Summary

The findings of this study may be summarized under three major areas.

1. Few respondents agreed that a pollution problem currently existed in the Big Stone Lake area. More respondents perceived an existing air pollution problem than a water pollution problem.

This was particularly interesting because the general pollution problem existing at the time of the study in the Big Stone Lake area was the abundance of algae growth in the lake. This condition frequently hindered recreational activities.

2. Respondents generally agreed that the operation of the power plant would add to the pollution in the area.

This perception of the power plant operation as a source of pollution seems to be based more upon a fear of the new and unfamiliar rather than knowledge of the situation. This was reflected in the high proportion of respondents indicating uncertainty concerning thermal pollution aspects of the power plant operation. Thermal pollution is one of the major types of pollution associated with power plant operations. The uncertainty of the respondents regarding this type of pollution indicates a lack of knowledge in this area.

3. Perceptions of the existence of pollution problems were associated with residence, income, occupation and organizational participation. Persons in blue collar and service occupational groups tended to disagree with the idea that there was a pollution problem, as did those with higher incomes.

Perceptions of the plant operation as a specific pollution source were associated with residence and participation in area organizations. Rural residents were least perceptive of the plant as a source of pollution. Larger proportions of town residents agreed that plant operation would add to pollution in the area.

Again, this residential aspect may be a function of the rural residents' greater recognition of the existence of a general pollution problem. The rural resident's concern with an additional source of pollution is probably not as great as the town resident's concern with something he perceives as new and, therefore, more threatening.

Organizational participation was associated with greater awareness of the plant operation as a source of pollution.

### Implications

The differences in perceiving a general pollution problem and perception of a specific potential pollution problem suggest the need for varied approaches to the problem of pollution.

Planners and others concerned with pollution control programs will need to create an awareness of existing pollution problems on the part of area residents.

People do not perceive existing pollution conditions as problems if they have made some type of adjustment. A re-definition of the situation will be necessary before people can become effectively involved in anti-pollution activities.

A new potential source of pollution introduced into an area is quite readily perceived by the residents. The planner or leader in this case will not have to devote efforts to redefining the situation, but will need to provide information to help people make action decisions.

Educational programs relative to pollution problem areas will need to consider residential, occupational and income characteristics of the intended audience, because perceptions of pollution problems vary with these characteristics.

If the purpose of such educational programs is to create awareness of pollution problems, the major emphasis should be with persons who are not active in organizations. However, if opinion leaders are needed or the support of persons already aware of the pollution problem are desired, efforts should then be channeled through community organizations.

## Appendix A-Regression Equations

1. Regression Equation  
Plant Pollution Analysis

$$Y = 22.5814 + (-) 6.573 x_2 + (-).6599 x_{11} + (-) 3.79 x_1 + (-) 3.084 x_3$$

$x_1, x_2, x_3$  -- Residential "dummy" variables

$x_{11}$  -- Social participation

$R^2$  -- All 14 variables .175

$R^2$  -- 4 variables .132

2. Regression Equation  
General Pollution Analysis

$$Y = 9.8824 + 2.674 x_1 + .311 x_{22} + 1.76 x_3 + .098 x_8$$

$x_1, x_2$  -- Residence "dummy" variables

$x_8$  -- Occupation

$x_{22}$  -- Income

## Appendix B--Supplemental Tables

**Table B-1**  
POPULATION TRENDS: PLANNING AND DEVELOPMENT  
Region: 1960-1970

REGION	POPULATION		
	1970	1960	CHANGE
Northeast South Dakota <sup>1</sup>	132,964	177,488	-25.1%
Western Minnesota <sup>2</sup>	189,729	191,804	-1.1%
West Central Minnesota <sup>3</sup>	134,313	146,977	-8.6%
TOTAL: 31-county PAD region	457,006	516,269	-11.5%
Township			
Geneseo	303	347	-12.6
Alban	487	641	-24.0
Big Stone	262	317	-17.3
Lake	242	286	-15.3
Becker	197	130	+51.5
Lockwood	168	181	-7.1

Source: United States Census of Population, Preliminary Report, 1970.

<sup>1</sup>Beadle, Brown, Brookings, Clark, Codington, Day, Deuel, Grant, Hamlin, Kingsbury, Marshall, Roberts, and Spink Counties in South Dakota.

<sup>2</sup>Becker, Big Stone, Clay, Douglas, Grant, Norman, Otter Tail, Stevens, Traverse, and Wilkin Counties in Minnesota.

<sup>3</sup>Chippewa, Kandiyohi, Lac Qui Parle, Pope, Redwood, Renville, Swift, and Yellow Medicine Counties in Minnesota.

**Table B-2**

PERCENT OF TOTAL EMPLOYMENT BY INDUSTRY: GRANT COUNTY;  
FOUR COUNTY REGION: AND THE UNITED STATES, 1969

Type of Industry	Grant	4-Co.	U.S.
Agriculture, forest and fisheries	44.5%	45.7%	6.7%
Mining and quarrying	0.2	0.5	1.0
Construction	3.9	4.0	5.9
Durable goods manufacturing	---	0.4	19.8
Other durable goods manufacturing	1.9	0.7	1.2
Food processing	3.7	3.2	2.8
Textiles and apparel manufacturing	2.2	0.1	1.5
Printing and publishing	1.0	0.6	1.8
Railroad transportation	0.9	0.5	1.5
Trucking	1.5	1.3	1.4
Other transportation	1.4	0.1	1.4
Communication	0.9	0.9	1.3
Utilities and service	0.5	0.5	1.4
Wholesale trade	2.1	2.8	3.4
Food stores	2.8	2.4	2.6
Eating and drinking places	1.9	3.0	2.8
Other retail trade	8.2	8.6	9.4
Finance, insurance, real estate	3.2	1.9	4.2
Business services	0.8	0.3	1.2
Repair services	1.6	1.8	1.3
Private household services	3.7	2.8	3.0
Other personal services	2.3	1.8	3.0
Entertainment	0.5	0.7	0.8
Hospitals	1.1	0.9	1.3
Public education	1.9	1.6	1.3
Private education	0.9	1.2	2.5
Welfare, religious, nonprofit organizations	2.5	3.1	5.0
Other professional services	0.5	1.2	4.0
Public administration			
Other not reported			

Source: Office of Business Economics, Letter to South Dakota State University, Rural Sociology Department, February 14, 1972.

**Table B-3**  
CHANGES IN AGRICULTURE IN BIG STONE LAKE AREA; 1964-1969

Area	Number of Farms		
	1969	1964	% Change
Minnesota	110,747	131,165	-15.5
Big Stone County	655	809	-19.0
South Dakota	45,726	49,703	-8.6
Grant County	909	1,017	-10.6
Roberts County	1,397	1,554	-10.1

Source: U.S. Bureau of the Census, Census of Agriculture, 1969. Vol. I, Area Reports, Part 15, Minnesota Section 2, County Data and Part 19 South Dakota, Section 2. Washington: U.S. Government Printing Office, 1971.

**Table B-4**  
NUMBER OF SAMPLE MEMBERS PARTICIPATING  
IN AREA ORGANIZATIONS

Organizations	Heads of Households
American Legion	32
V.F.W.	25
4-H Clubs	8
Farmer's Union Co-op	25
Jaycees	7
Home Extension Clubs	3
N.F.O.	19
Farm Bureau	2
Grange	1
Chamber of Commerce	16
Kiwanis	8
Masonic Order	11
Knights of Columbus	10
Elks	3
Scouts (Boy or Girl)	3
Religious	59
Others	17

**Table B-5**  
 POPULATION TRENDS: TOWNS OF ONE THOUSAND  
 OR MORE PERSONS WITHIN A FORTY MILE RADIUS  
 OF BIG STONE CITY: 1960-1970

TOWN	1970	1960	CHANGE
Appleton, Minnesota	1,783	2,172	-17.9%
Clear Lake, South Dakota	1,127	1,137	-0.9%
Dawson, Minnesota	1,677	1,766	-5.0%
Madison, Minnesota	2,257	2,380	-5.2%
Milbank, South Dakota	3,679	3,500	+5.1%
Morris, Minnesota	5,120	4,199	+21.9%
Ortonville, Minnesota	2,816	2,679	+5.3%
Sisseton, South Dakota	2,913	3,218	-9.5%
Watertown, South Dakota	13,248	14,077	-5.9%
Wheaton, Minnesota	2,011	2,102	-4.3%
Big Stone City, South Dakota	631	737	-12.1%

Source: United States Census of Population, Preliminary Report, 1970.

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