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Demographic and Violation Characteristics of Inspected Minnesota Hazardous Waste Generators: 1994-1996

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DEMOGRAPHIC AND VIOLATION CHARACTERISTICS OF INSPECTED

MINNESOTA HAZARDOUS WASTE GENERATORS: 1994-1996

by

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Hazardous waste generators that deviate from federal and state environmental regulations pose a threat to the environment and the reputation of law-abiding businesses. The aim of this study was to identify characteristics of inspected Minnesota hazardous waste generators so that environmental enforcement officials may be better able to educate themselves and prevent future violations by hazardous waste generators by knowing where to focus their attention. A sample of 708 inspected hazardous waste generators for the years 1994 to 1996 was collected from the Minnesota Pollution Control Agency (MPCA). The data were examined by size of generator (Very Small Quantity Generators [VSQG], Small Quantity Generators [SQG], and Large Quantity Generators [LQG]) to determine whether statistically significant differences existed between generator size and the demographic variables, inspections, violations and penalties. The results of this study found that, generally, smaller quantity generators had significantly more inspections, more violations, were more likely to be from greater Minnesota counties and involved in agricultural-related industry; surprisingly, LQGs received more penalties. As a result of this study, the MPCA must either train smaller quantity generators through more inspections or seek alternative forms of enforcement (i.e., criminal sanctions) to ensure generators are in compliance with the law.

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INTRODUCTION

Historically, the State of Minnesota has prided itself on its healthy and livable environment. In the Minnesota Pollution Control Agency's (MPCA) 1996 Program Self Assessment, the MPCA Commissioner reports that a national study ranked "Minnesota's economy and environmental protection second and seventh respectively in the nation" (p. 1). There are threats to our environment, however. In a statement made by Minnesota Attorney General Hubert H. Humphrey III on December 14, 1992, "Approximately 16 million pounds of hazardous waste are generated in Minnesota each year; about 10 million pounds are disposed of illegally" (personal communication, December 14, 1992).

This study will explore the characteristics of one subset of environmental law/regulation offenders in Minnesota--hazardous waste generators--by examining the records of the MPCA between 1994 and 1996. Hazardous waste generators were chosen because these businesses are represented state-wide in large numbers and have the potential to cause great harm to the environment through improper handling and management of their waste. Specifically, demographic and regulatory characteristics of hazardous waste generators will be probed as a whole, and then by group (Very Small Quantity Generators [VSQG], Small Quantity Generators [SQG], and Large

Quantity Generators [LQG]). Once these characteristics are known, environmental enforcers in Minnesota may be better able to educate themselves and prevent violations of environmental laws/regulations by hazardous waste generators.

BACKGROUND

To date there has been little research on hazardous waste generators and their characteristics. Information on generator offenders is often limited to scholarly legal reviews and is often qualitative in nature. The following articles are important from a generalist's standpoint in that they provide a backdrop for the research presented.

Literature Review

Resource Conservation and Recovery Act of 1976 (RCRA). Largely, hazardous waste generators are regulated by federal law, specifically the Resource Conservation and Recovery Act of 1976 (RCRA). Initially this law only applied to Large Quantity Generators (generators producing in excess of 1,000 kgs of hazardous waste per month). This law "establishes a framework for regulating hazardous waste from generation to disposal or what is known as the 'cradle to grave' concept" (Hammett & Epstein, 1993, p. 3). Generally, RCRA regulates record keeping and reporting requirements for hazardous waste generators through a permitting system. An extensive review of RCRA, its requirements and an analysis of its impact on hazardous waste generators in the United States can be found in the Environmental Protection Agency's (1995) National Analysis: The National Biennial RCRA

Hazardous Waste Report. Additionally, the EPA (1996) offers Understanding the Hazardous Waste Rules: A Handbook for Small Businesses--1996 Update, a publication which outlines RCRA and its requirements for the layperson.

In an effort to account for RCRA's limitations, hazardous waste and solid waste amendments were added to the Act in 1984. These regulations were extended to smaller quantity generators--those producing 1,000 kg or less of waste per month (Hammett & Epstein, 1993, p. 4). Many thorough reviews of RCRA requirements and implications have been written (Abensohn, Bombardo, Braumuller, & Cadeddu, 1993; Weiner, Johnson, & Kelly, 1991) as well as an equally informative legal review of environmental laws across the 50 states (DeCicco & Bonanno, 1989).

Criminal and regulatory enforcement. The existing RCRA statute with its amendments has led to a great deal of controversy in enforcement circles regarding the best method of enforcement. Many believe the best way to enforcement environmental laws is through regulatory and administrative measures, this being a more tolerant approach which allows for education in lieu of punishment. On the other hand, many enforcement officials and scholars alike believe regulatory and administrative measures provide no deterrent, thus suggesting that criminal enforcement is more appropriate (Adler & Lord, 1991; Barnett, 1993; Devaney, 1992; DiMento, 1993; Marzulla & Kappel, 1991; Strock, 1991; Thornburgh, 1991). These articles push for criminal enforcement sanctions leaving the reader with the impression that civil and regulatory sanctions more often than not fail; these sanctions tend to be passed on to the consumer by business as part of the "the cost of doing business."

White-collar crime and liability. Additional research in environmental crime focuses on issues of corporate liability and methods of prosecution in white-collar crime. Unlike civil and regulatory penalties, criminal sanctions are levied against individuals in a company--not the corporate entity. As several articles point out, there are a myriad of legal issues to address in a criminal case (i.e., level of individual knowledge, intent of individual) which make the "beyond a reasonable doubt" burden of proof a tough standard to prove in environmental crimes (Abensohn et al., 1993; Benson, 1985; Celebrezze, Muchnicki, Marous, & Jenkins-Smith, 1990; McElfish, 1987; Parker, 1992).

Hazardous waste generators. Quantitative research on hazardous waste generators is limited. In a study by Gebrewold (1994) the three sizes of generators were surveyed to assess the types of waste produced, quantities of waste generated and disposal methods used. According to this study, smaller quantity generators were more likely to dispose of hazardous waste in an illegal fashion. However, the author acknowledged the differences were not statistically significant and that the sample sizes were too small to generalize to the larger generator population.

Research done for the Office of Policy Analysis for the U.S. Environmental Protection Agency by Savant Associates, Inc. and Response Analysis Corporation

(1983) suggested that 85-90% of large quantity generators were complying with RCRA regulations. Further, Hammett and Epstein's (1993) Local Prosecution of Environmental Crime suggested that the major problem of noncompliance probably lies with the small quantity generator (SQGs). Finally, Donald Rebovich's (1986) Understanding Hazardous Waste Crime: A Multistate Examination of Offense and Offender Characteristics in the Northeast, revealed that when enforcement staff from 14 different states were interviewed, a general consensus was reached that small quantity generators have the highest instances of illegal disposal.

The Minnesota Pollution Control Agency (MPCA)

The MPCA was created by the Minnesota Legislature in 1967. The Commissioner of the MPCA as well as an eight member Citizens Board are appointed by the Governor. The following, taken from the MPCA's 1996 Program Self Assessment, describes the MPCA's organization and mission. "The MPCA is organized into four program divisions, one regional division and one support division. The programs are: 1) Air Quality, 2) Ground Water and Solid Waste, 3) Hazardous Waste and 4) Water Quality" (p. 1). The MPCA has a combination of technical personnel (biologists, chemists, etc.), attorneys and support staff that run day-to-day operations. The mission of the MPCA is to "protect Minnesota's environment to secure the quality of life of its citizens" (p. 2).

Hazardous Waste Information Management System (HWIMS)

This study focused specifically on MPCA data. The MPCA was chosen because in Minnesota it has the most comprehensive computerized database of Minnesota generators--the Hazardous Waste Information Management System (HWIMS). The HWIMS system is composed of separate databases (evaluation, violation, enforcement action and penalty information databases) which allow MPCA personnel to enter data on items related to hazardous waste generators. Once this information is entered into the HWIMS computer, it is ultimately uploaded into the Environmental Protection Agency's mainframe computer in North Carolina. The EPA maintains these data for all 50 states.

The Rules

The MPCA regulates Minnesota hazardous waste generators under authority of Minnesota Rules, Chapter 7045. Additionally, the MPCA consults with metro (Anoka, Carver, Dakota, Hennepin, Ramsey, Washington, and Wright), and greater Minnesota (the remaining 80 Minnesota counties) county personnel to educate hazardous waste generators on the necessary rules to gain compliance with state and federal law. The MPCA uses more of its resources in the greater Minnesota counties than the metro area; this is due largely to the lack of resources and expertise in greater Minnesota. Metro area environmental offices are staffed in such a way, with technical and enforcement personnel, that it reflects the makeup of the MPCA.

What follows is a brief overview of MN Rules, Chapter 7045, as they apply to hazardous waste generators; it may be helpful to note at this point that the Rules reflect federal statutes, specifically RCRA, with the solid and hazardous waste amendments which are enforced by the EPA.

Characteristics of hazardous waste (7045.0131). The State of Minnesota defines hazardous waste as anything having any one of the following properties: 1) Ignitable--a flash point below 140° F; 2) Oxidizer--readily supplies oxygen to a reaction in the absence of air; 3) Corrosive--a pH less than or equal to 2.0 or greater than or equal 12.5, or corrodes steel at a rate greater than 6.35mm (.250 in.) per year at a test temperature of 55° C; 4) Reactive--explosive, unstable, or generates toxic gases or reacts violently with water; 5) Lethal--an oral dose LD50 less than 500mg/kg, or a dermal LD50 less than 1,000 mg/kg, or an inhalation LC50 less than 1000mg/m3; and 6) Toxic--contains leachable quantities of a certain contaminant. Appendix E shows a detailed listing of hazardous wastes from both specific and nonspecific sources.

Hazardous waste management (7045.0208). Generators must ensure that their wastes are delivered to a permitted treatment, storage and disposal facility (TSDF) or to a facility that under MN Rule 7045.0125 will beneficially reuse or recycle the waste or treat the waste on-site in accordance with MN Rule 7045.0211. The generator must not relinquish control of the waste if the generator has reason to believe the waste may not be properly managed.

Identification number (7045.0221). A generator must obtain a site specific EPA identification number prior to the transportation, treatment, storage or disposal of any hazardous waste.

Generator license (application and renewal; 7045.0225-.0255). Whoever generates hazardous waste must obtain a hazardous waste generator license for each individual generation site. The license must be reviewed on an annual basis and be posted at the licensed site in a public area.

Manifest (7045.0261-.0265). A generator must prepare a manifest before shipping hazardous waste off-site for treatment, storage, or disposal.

Pretransport requirements (7045.0275). Prior to transporting or offering hazardous waste for transportation, a generator must mark and package the waste in accordance with Department of Transportation regulations. The generator must placard or offer the initial transporter placards for the waste shipment.

Proper hazardous waste management (7045.0275). Spills, leaks, or other releases must be immediately reported to the MPCA if the waste may cause pollution of the air, land resources, or waters of the state.

Accumulation of hazardous waste (7045.0292). This rule specifies accumulation requirements based on generator size and describes satellite accumulation, transportation, time extension, and accumulation requiring a permit. All generators are required to label hazardous waste storage containers and tanks with the words "Hazardous Waste," a description that clearly identifies the contents to employees and emergency response personnel, and with a start date of accumulation.

Record keeping (7045.0294). This rule specifies record keeping requirements for manifests, very small quantity generator collection program receipts, license application, exception reports, container inspection logs, and test results. Records must be maintained at the licensed site.

Preparedness and prevention (7045.0566). Hazardous waste generators must ensure that their facilities are maintained and operated to minimize the possibility of fire, explosion, or any unplanned sudden or nonsudden release to air, land or water of waste which could threaten human health or the environment. Required emergency equipment, access to communications or alarm systems, and requirements for aisle space are specified in this rule.

Arrangements with local authorities for emergencies (7045.0568). Generators must submit a notification to local authorities (police, fire, and hospital) to familiarize response personnel with the layout of the facility, properties of hazardous waste handled at the facility, places where the facility personnel would normally be working, and entrance/evacuation routes.

Use and management of containers (7045.0626). Generators must ensure that their hazardous waste is stored in sturdy containers which are compatible with the waste being stored and that weekly inspections of hazardous waste storage areas and containers are conducted and documented.

Minnesota Environmental Enforcement Structure

At the state level there are several branches of government involved in environmental enforcement: the Minnesota Pollution Control Agency (MPCA), the Minnesota Attorney General's Office, the Department of Transportation, the Department of Agriculture, the Department of Natural Resources and, on the federal level, the EPA. These organizations often collaborate on investigative efforts, as well as share information and other resources.

Environmental Violation Investigation and Case Flow

Investigation of environmental offenses follows some very basic stages, whether enforced by regulatory or criminal officials. Hammett and Epstein (1993) outline eight stages of environmental investigation: detection of offense, collection of background information, surveillance of suspects, evidence collection, laboratory analysis, charging, adjudication, and cleanup/compliance. Generally, the case flow for the MPCA will follow these stages. It is important to keep in mind that at any stage the MPCA may refer a case for alternative (criminal or civil) processing; such actions, however, fall outside the scope of this study which deals strictly with regulatory/administrative penalties. It should be noted at this point that the descriptions of the stages that follow are general in nature; the aim is to provide a frame of reference for the reader.

The Stages

Offense detection. Offenders are detected in a number of ways, including "tips from employees or former employees, members of the public, and environmental advocacy groups" (Hammett & Epstein, 1993, p. 19). Additionally, regulatory agencies, like the MPCA, may detect violations by either routine inspection of hazardous waste generators or by targeting known violators. Most of the cases represented in this study were either follow-up from previous inspections or routine inspections.

Data collection. After a known violator has been identified, vital information is collected; they will likely show up in a particular agency's database. This is the case with the MPCA's HWIMS database and various county databases. Ultimately, these generators have their records on file with the EPA.

Surveillance. At the next stage, surveillance, the suspect generator will be more closely monitored. This is done in a number of ways: monitoring a generator's waste stream, utilizing aerial photography, or looking for out-of-the-ordinary business practices.

Evidence collection. Next, the enforcement effort likely will focus on evidence collection. Collection of evidence can occur through routine on-site inspections or by inspections that specifically target known violators. The type of evidence that is gathered can vary from water, soil, or waste stream samples to business documents (i.e., bills of lading, manifests, purchase orders) or witness statements. Next, the evidence may by analyzed at a lab to determine any harmful characteristics present. Upon completion of the analysis, appropriate sanctions can be determined.

Compliance. Finally, the MPCA ensures that a violator has complied with the settlement agreement (commonly through reinspection). If a company has not complied with administrative sanctions, further civil or criminal injunctions can be pursued. However, it should be noted that regulatory agencies typically use criminal sanctions as a last resort. A study by the Rand Corp revealed that "regulators are likely to have an ongoing relationship with firms and be more sensitive to business pressures, seeking non-criminal enforcement" (Hammitt & Reuter, 1988, p. 28).

OPERATIONAL DEFINITIONS

County. For purposes of this study, counties considered metro (those with a higher population density--the Twin Cities and the surrounding suburban areas) are Anoka, Dakota, Hennepin, Ramsey, Carver, Wright and Washington; conversely, the remaining 80 counties are considered greater Minnesota.

Environmental offense. Any violation of the eight federal environmental statutes (Clean Air Act; Clean Water Act; Refuse Act; Safe Drinking Water Act; Resource Conservation and Recovery Act; Comprehensive Environmental Response, Compensation and Liability Act; Toxic Substances Control Act; and the Federal Insecticide, Fungicide and Rodenticide Act) and/or Minnesota Rules, Chapter 7045.

Industry type. For purposes of this study, the federal government's Standard Industry Code (SIC) will be used to classify industry. These codes will be collapsed into six categories: agriculture, manufacturing, transportation, services, trade, and other (Appendix D).

Generator size. Minnesota Rules (1995) classify the generator industry by the volume (measured in kilograms) of hazardous waste created (post production use, not raw material): Very small quantity generators (VSQG), small quantity generators (SQG), and large quantity generators (LQG). Very small quantity generators produce less than 100 kgs of hazardous waste per month, SQGs produce between 100 and 1000 kgs of hazardous waste per month, and LQGs produce in excess of 1000 kgs of hazardous waste per month. Note: 100 kilograms is roughly equivalent to 220 pounds or 22 gallons.

Inspection type. For purposes of this study, inspection types fall into seven categories: Compliance Evaluation Inspection (CEI)--an on-site evaluation of the compliance status of the handler with regard to all applicable RCRA regulations and permits; Compliance Monitoring Evaluation (CME)--a detailed evaluation of the adequacy of the design and operation of a facility's ground water monitoring system; Financial Record Review (FRR)--an extensive detailed review of a handler's compliance with financial responsibility requirements; Non-financial Record Review (NRR)--an evaluation involving a detailed review of non-financial records; Operation and Maintenance Inspection (OAM)--periodic inspection of how well a ground water monitoring system continues to function once it is considered or other revaluation conducted to verify compliance with enforcement actions resulting from a previous evaluation, or to review deficiencies noted in a previous inspection; Sampling Inspection (SPL)--evaluation type in which samples are collected for laboratory analysis and Other inspections (OTH).

Inspection reason. Inspection reasons fall into two categories: original or follow-up inspections. Original inspections are usually first encounters by the inspector with a particular business, typically samplings of waste, educational assistance visits or the result of citizen complaints. Follow-up inspections involve any action involved by the inspector after an original inspection, i.e., case development, closures or compliance assistance visits.

Violation type. The violation types germane to this study were previously mentioned in the Rules subsection of the proposal. In accordance with the MPCA the Rules mentioned earlier are collapsed into broader categories. These categories are Generator-General Requirements (GGR; personnel training, preparedness/prevention, notification/disclosure, financial responsibility and annual reports), Generator Manifest Requirements (GMR; manifesting, exception reporting and unmanifested waste reporting), Generator Pre-transport Requirements (GPT; storage, handling, and accumulation of hazardous waste), Generator Recordkeeping Requirements (GRR; contingency planning and record keeping), Generator Special Condition (GSC; farmers), Generator Small Quantity Generator Requirements (GSQ; special requirements for SQG), General Land Ban Requirement (GLB; land disposal restrictions) and Generator-Other (GOR; improper disposal, county ordinances, compliance schedule and ground water).

Violation priority. The inspector at the site will assess a priority to the violation; this number is based on a scale of 1 (low priority) to 9 (high priority).

Violation class. A numeric code indicating the relative severity of the violation discovered as a result of an evaluation or the pending nature of a potential violation. Class 1 violations are deviations from regulations, or provision of compliance orders, consent agreements, consent decrees or permit conditions which could result in a failure to: a) assure hazardous waste is destined for and delivered to an authorized TSDF facility; b) prevent releases of hazardous wastes; c) assure early detection of such releases or d) perform emergency clean-up operation or other corrective action for releases. A Class 2 violation is any violation of RCRA requirements that does not meet the criteria for Class 1 violations. It should be noted that a Class 1 or Class 2 violation is not a measure of severity, rather just a means of classification.

Enforcement action. For purposes of this study, enforcement actions fall into several categories; they are notices of violation (NOV), executed stipulation agreements and administrative penalty orders (APO; can be forgivable, non-forgivable, or a combination of both). Administrative penalty orders are given as the result of an inspection; they identify violations of Minnesota rules/statutes and must be corrected within a period of time after issuance of the order. Depending on the nature of the order, it may be deemed non-forgivable (payment of a fine or other penalty) or forgivable (no fine or other penalty action). Appendix F shows an example of forms associated with an APO.

Penalty. If violations are not corrected in accordance with the previously mentioned enforcement action, penalties can then be assessed. The Commissioner of the MPCA considers many items in order to determine if a penalty will be issued and how large it will be, they are: willfulness of the violation(s), the economic benefit gained by the company, the history of past violations, the number of violations and the gravity of the violation(s)--to include the potential for damage to humans, animals, air, water, land and other natural resources of the state. For a repeat violation(s), the Commissioner considers similarities to previous violations, time elapsed since the last violation, number of previous violations, past response to violations and the previously mentioned items.

Model

The characteristics and the proposed hypotheses are diagrammed below in Figure 1 and explained later.

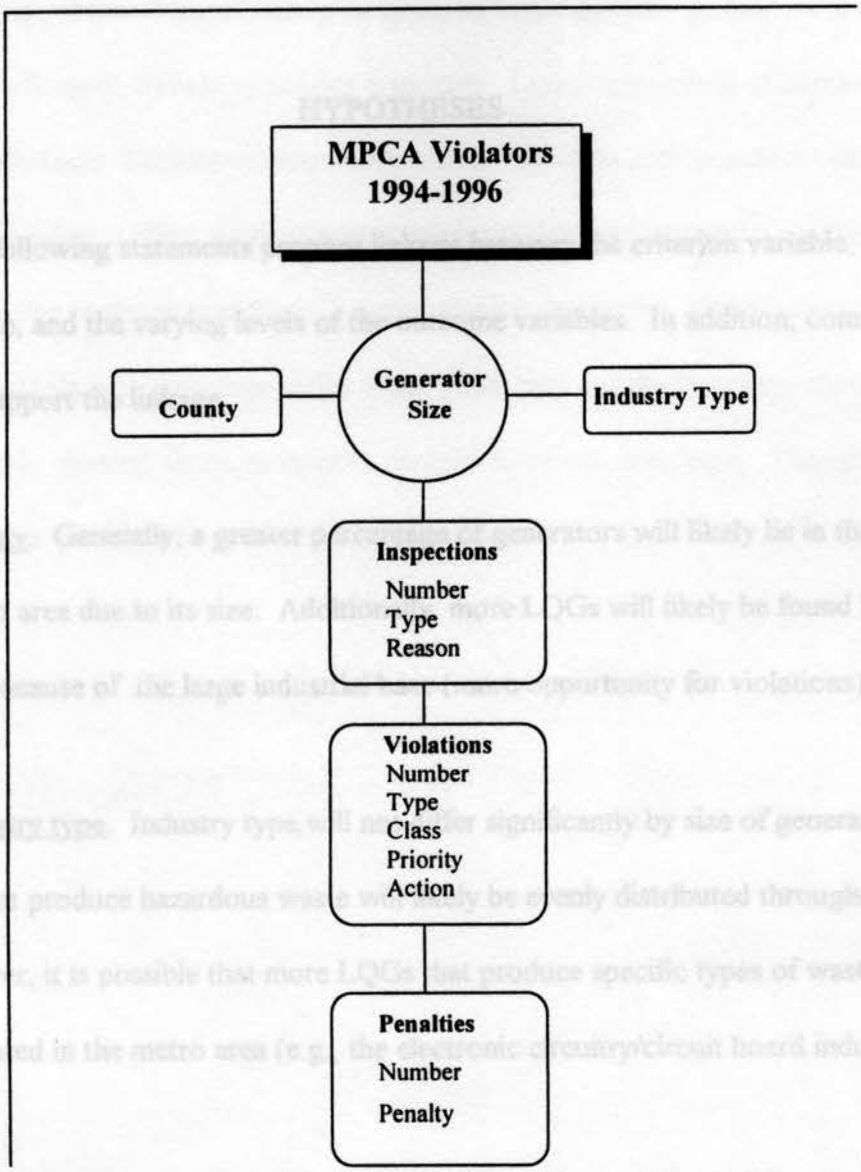

Figure 1

Research Model

HYPOTHESES

The following statements propose linkage between the criterion variable, generator size, and the varying levels of the outcome variables. In addition, commentary is given to support the linkage.

County. Generally, a greater percentage of generators will likely lie in the seven county metro area due to its size. Additionally, more LQGs will likely be found in the metro area because of the large industrial base (more opportunity for violations).

Industry type. Industry type will not differ significantly by size of generator. The industries that produce hazardous waste will likely be evenly distributed throughout the state; however, it is possible that more LQGs that produce specific types of wastes will be concentrated in the metro area (e.g., the electronic circuitry/circuit board industry).

Inspections. The number of inspections, type of inspections and the reason for inspections will not vary significantly by generator size.

Violations. Number of violations, type of violation, class of violation, priority of violation, and resulting actions taken will not vary significantly by size of generator.

<u>Penalties</u>. More fines will likely be given to larger quantity generators since these generators are likely to be held to stricter standards. Larger generators of hazardous waste (typically larger businesses) may be viewed as reputable and "standard bearers" by the public and industry alike; when a larger business violates a law/regulation they are more likely to "be made an example of " than a smaller generator. Additionally, larger quantity generators will likely face stiffer fines. First, they are likely to have the funds to pay larger fines. Second, these generators are held to stricter standards. The result of waste violations will likely be reflected in higher fines.

RESEARCH STATEMENT

The purpose of this research was to analyze existing MPCA data on the size of hazardous waste generators and determine whether statistically significant comparisons existed between generator size and the variables of county, industry type, inspection, violation and penalty. When these data were analyzed they could educate enforcement personnel about characteristics of hazardous waste generator offenders and, in turn, prevent future offenses by generators. The time frame used in this research was from January, 1994 to October, 1996; data collected prior to 1994 was not very well managed or readily accessible. This study was geographically limited to Minnesota.

DATA COLLECTION AND ANALYSIS PROCEDURES

Data Collection

Data were collected from the MPCA's records; these data are public information pursuant to Minnesota Rules 7000.1200. Overall, 708 cases were randomly selected from HWIMS for analyses: VSQGs (321), SQGs (201) and LQGs (185). This best represents the actual generator population in Minnesota--by the MPCA's estimate, in 1994 there were 25,000 VSQGs, 4,900 SQGs and 1,500 LQGs (MPCA, 1994). Additionally, the MPCA's limited resources only allow it to visit approximately 400 hazardous waste generators a year across all groups (MPCA, 1994). Contact with the MPCA was made via telephone conversations, on-site visits with Agency personnel and electronic mail. With the assistance of MPCA technical staff, data were collected from HWIMS via the Internet and coded using the scheme in Appendix B.

Data were collected from the inspections, violations and penalties databases mentioned earlier and saved in spreadsheets. Next, the data were linked by a unique number (in this case, EPA ID number) and the separate spreadsheets were merged into a database program. Finally, the files were uploaded into SPSS for analysis (Appendix C). Figure 2 gives a graphic illustration of the HWIMS database set-up.

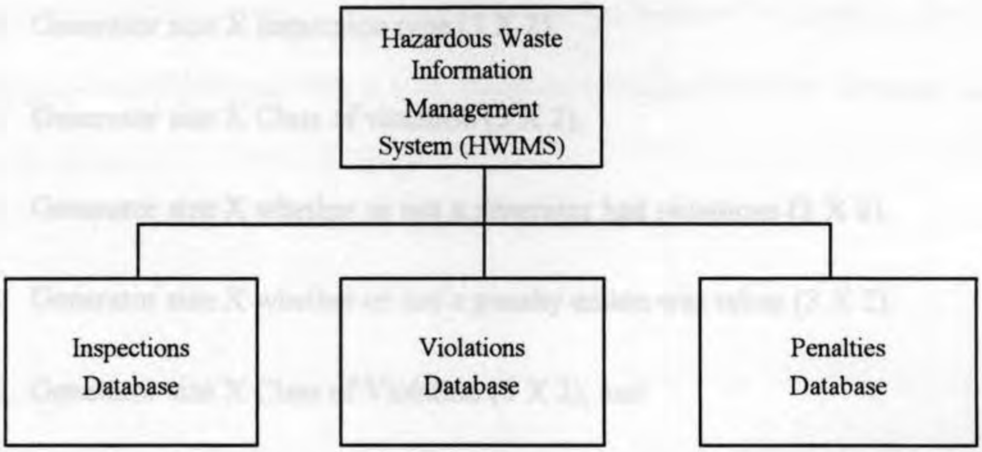

Figure 2

HWIMS Database Layout

Data Analysis

Once data collection was complete, several different statistical procedures were run using the Statistical Package for the Social Sciences (SPSS), Version 7.0 (SPSS Inc., 1996). First, a frequency distribution was run on the three sizes of generators: VSQGs, SQGs and LQGs. Next, type of generator was analyzed by the categorical dependent variables using chi-squares with Monte Carlo estimates. These analyses were as follows:

1. Generator size X County (3 X 2),
2. Generator size X Industry type (3 X 6),

3. Generator size X Inspection reason (3 X 2),

4. Generator size X Inspection type (3 X 2),

5. Generator size X Class of violation (3 X 2),

6. Generator size X whether or not a generator had violations (3 X 2),

7. Generator size X whether or not a penalty action was taken (3 X 2),

8. Generator size X Class of Violation (3 X 2), and

9. Generator size X Type of enforcement action taken (3 X 5).

Further, the continuous dependent variables were analyzed with One-Way Analyses of Variance (ANOVA). Where significant Fs appeared, post hoc Scheffe tests were run to show differences between the three generator size categories. One-way ANOVAs were run on the following variables:

1. Number of Inspections X Generator Size,
2. Number of Violations X Generator Size,
1. GGR, GMR, GPT, GRR, GSQ, GLB & GOR Violations X Generator Size,
2. Violation Priority X Generator Size,
3. Number of Penalty Actions taken X Generator Size, and
4. Penalty Amount X Generator Size.

Finally, a discriminant analysis was run. The purpose of this analysis was to create a model to determine whether the variables listed in Appendix B can distinguish between characteristics of those that were offenders of hazardous waste regulations and those that were not. Such predictor characteristics could be used by enforcement officials to target certain aspects of businesses or generators instead of using larger, more ambiguous classifications; this, in turn, could save vital enforcement resources and be more cost effective.

RESEARCH DESIGN

This study used a passive statistical design (Eck & LaVigne, 1994). This type of design best suited the main goal of this research: to determine whether or not a problem existed (in relation to the independent variable, generator size, and the various dependent variables) so policy can be crafted which will best help to regulate, enforce and educate hazardous waste generators. The author readily admits that such a design has its limitations, mainly the inability to control group selection, treatment level, assignment of subjects to groups or having the treatment precede the outcome (Eck & LaVigne, 1994). Additionally, there were a number of confounding variables that were difficult to explain. With these limitations in mind, the results of this study could still be used to craft a policy to address problems with generators and eventually serve as a pilot to a larger study.

This research was not intended to offer definitive answers to problems involving hazardous waste generators, nor does it purport that one type of enforcement was more effective than another (i.e., criminal, civil or administrative); its goal was to initiate quantitative field research in a mostly untouched subject area.

RESULTS

The results of this study will be presented in the following order: demographic-, inspection-, violation- and penalty-related variables. This method was chosen since it is the order of progression the MPCA uses to develop cases (inspection-violation-penalty action). Since this is the case, there will be fewer generators proceeding in the advanced stages of violation and penalty.

Demographics

Overall, a total of 708 cases were included for analyses in the study. Of these, 321 or 45% were VSQGs; 202 or 29% were SQGs; and 185 or 26% were LQGs. Additionally, 134 or 19% of generators were from metro counties and 574 or 81% were from greater Minnesota counties. As can be seen in Table 1, 54% of VSQGs were from greater Minnesota counties, compared to 29% for SQGs and 17% for LQGs. These percentages are not terribly alarming when the accompanying frequencies for the Standard Industrial Codes (SICs) are examined (Table 1). The agricultural industry is far more represented by VSQGs at 73% than either SQGs-23% or LQGs-4%. It should also be noted when looking at manufacturing the reverse trend is true (LQGs-41%, SQGs-34% and VSQGs-25%). Indeed, greater Minnesota counties have more of an agrarian base, whereas metro counties have more of an industrial/manufacturing base.

Table 1

Frequencies of Generator Size by County and Standard Industrial Classification (SIC)

	County		SIC major categories					
	Metro	Greater MN	Agri.	Manuf.	Trans/ Comm	Services	Trade	Other
	Generator size (in %)	Generator size (in %)	Generator size (in %)	Generator size (in %)	Generator size (in %)	Generator size (in %)	Generator size (in %)	Generator size (in %)
VSQG	9	54	73	25	34	55	66	27
SQG	26	29	23	34	34	29	34	31
LQG	65	17	4	41	31	15	0	42
Total	100	100	100	100	100	100	100	100

Inspections

A chi-square with a Monte Carlo estimate was run on type of inspection (original or follow-up). Very small quantity generators and small quantity generators had significantly more original inspections than large quantity generators; conversely LQGs had significantly more follow-up inspections than SQGs or VSQGs, $\chi^2(2, N = 330) = 13.32, p < .002$, which can be seen in Figure 3. These results likely indicate problems with LQGs, since follow-up inspections are usually the result of deficiencies found in original inspections. The larger percentages of original inspections for smaller quantity generators may be indicative of the MPCA educating smaller generators; such inspections could include overviews of existing laws, hazardous waste management education or general seminars, such original inspections would not require a follow-up.

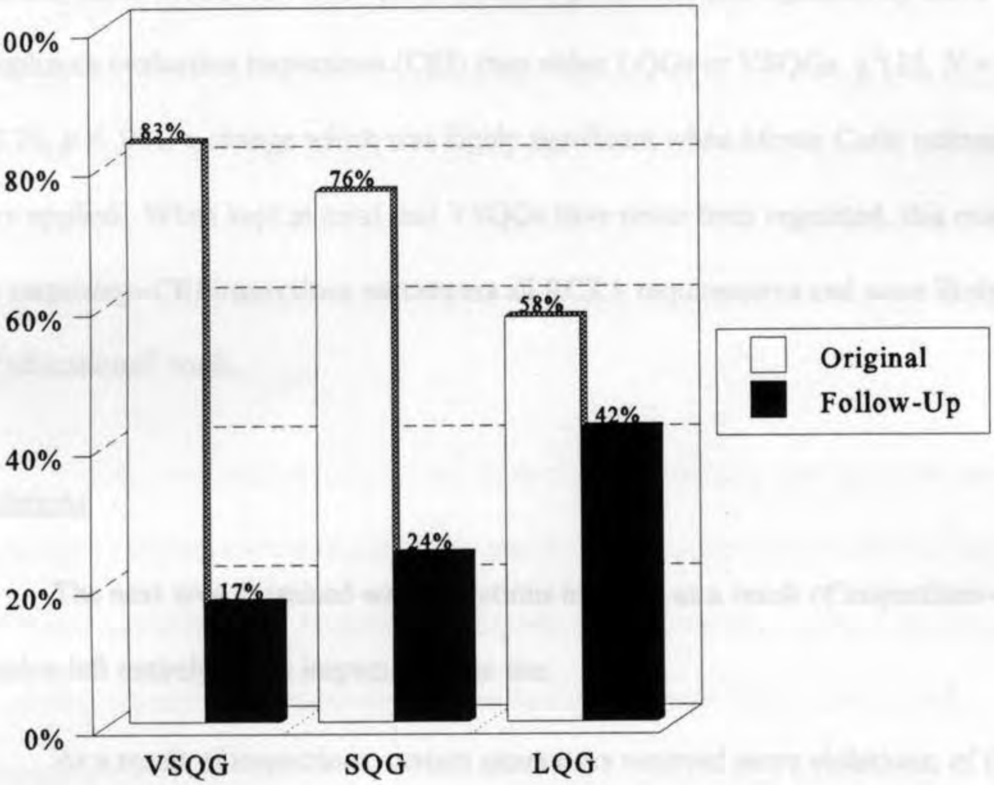

Figure 3

Inspection Type by Size of Generator

Next, an ANOVA was run on the number of inspections among the three types of generators. The ANOVA was significant $F(2, 705) = 4.08)$, $p < .02$. A post hoc Scheffe test pinpointed the difference between the means of VSQGs ($M = 1.58$) and SQGs ($M = 1.88$). Next, chi-squares with Monte Carlo estimates were run on the eight categories of violations; in instances where there was more than one type of violation per business, the first one was used. Small quantity generators had significantly more compliance evaluation inspections (CEI) than either LQGs or VSQGs $\chi^2(12, N = 708) = 138.76$, $p < .001$, a change which was highly significant when Monte Carlo estimates were applied. When kept in mind that VSQGs have never been regulated, this result was not surprising--CEI inspections encompass all RCRA requirements and were likely used as "educational" tools.

Violations

The next area examined were violations incurred as a result of inspections--a decision left entirely to the inspector at the site.

As a result of inspections, certain generators received more violations; of these, SQGs had significantly more violations than VSQGs or LQGs $\chi^2(2, N = 708) = 29.23$, $p < .001$. Additionally, an ANOVA was run to determine which generator had more violations; no significant differences were found (${}^{VSQG}M = 3.84$, ${}^{SQG}M = 4.51$, and ${}^{LQG}M = 4.13$). Eight additional ANOVAs were run to determine whether differences existed between generator size and type of violation received; none of the eight were statistically significant. The mean number of violations for each violation category and their corresponding *F*s were: GGR: 2.12, $F(2, 246) = .075$; GMR: 1.46, $F(2, 109) = .265$; GPT: 2.95, $F(2, 219) = .385$; GRR: 1.52, $F(2, 28) = .955$; GSQ: 4.90, $F(1, 8) = .873$; GLB: 1.86, $F(2, 33) = .187$; GOR: 1.29, $F(2, 93)$, and there were too few groups to run a *F* for GSC violations.

Next, a chi-square run between generator size and class of violations (1 or 2) revealed no statistically significant differences. Further, inspector-assigned violation priorities, based on a scale of one to nine (one being a low priority violator and nine being a high priority violator) were examined with an ANOVA. The ANOVA was not significant $F(2, 406) = .107$. The means for the three groups were: VSQGs = 4.07, LQGs = 4.16, SQGs = 4.06.

Finally, a chi-square was run on the first type of enforcement action by size of generator. For purposes of this analysis, non-forgivable APOs, forgivable/non-forgivable APOs and non-forgivable APOs were collapsed into one variable, APO (since they are all varying degrees of the same type of enforcement action). Very small quantity generators had significantly more NOV enforcement actions than either SQGs or LQGs when Monte Carlo estimates were applied $\chi^2(4, N = 110) = 17.58$, $p < .001$. Figure 4 shows the breakdowns of first enforcement actions by generator. Smaller quantity generators were given significantly more NOVs (warnings) and larger quantity generators were given more APOs (notices of pending penalty action); these results were consistent with those revealed in Figure 3 which concerned original and follow-up inspections.

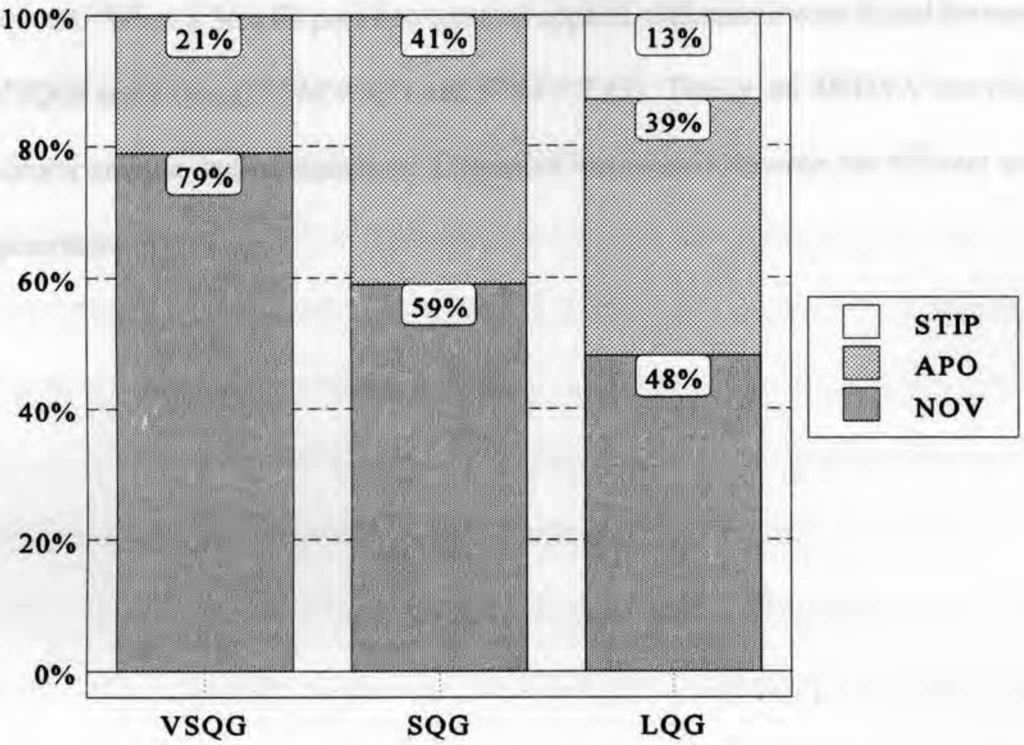

Figure 4

Generator Type by First Enforcement Action

Penalties

When violators failed to comply with inspection findings and later violations, penalty actions were levied in the form of fines.

Whether or not penalty actions were taken against a particular generator revealed no significant differences when examined with a chi-square. Next, the number of penalty actions were examined with an ANOVA. The ANOVA was significant $F(2, 38) = 4.58$, $p < .02$. When a Scheffe post hoc test was applied, differences were found between VSQGs and LQGs ($^{VSQG}M = 3.31$ and $^{LQG}M = 7.45$). Finally, an ANOVA was run on penalty amount, but no significant differences were found between the different sizes of generators.

DISCUSSION

First, VSQGs were far more represented in greater Minnesota counties as opposed to SQGs or LQGs. Additionally, the industries most represented by VSQGs were agricultural, e.g., sewage run-off from livestock farms. These results are surprising and could represent a shift of emphasis by the MPCA from pursuing large quantity generators to smaller quantity generators. This could also be the result of the larger representation of small quantity generators.

Second, when further probed, VSQGs and SQGs were significantly more likely to have original inspections than LQGs. Additionally, LQGs were significantly more likely to have follow-up inspections that VSQGs or SQGs. This could be the result of many things: 1) smaller quantity generators are more represented in this study; 2) there are more complaints concerning smaller quantity generators requiring original inspections, or 3) the MPCA may be attempting to educate smaller quantity generators (and, in this case agriculture-related industry). It is unclear which of these reasons, if any, may be the most fitting. However, it is clear that LQGs are receiving more follow-up inspections which resulted from deficiencies in original inspections.

It is apparent that some type of disparity exists when the group having fewer original inspections is having more follow-up inspections.

Furthermore, VSQGs had significantly more inspections, with compliance evaluation inspections (CEI) being the most likely received. A CEI is an on-site evaluation of the compliance status of the handler with regard to all RCRA regulations and permits. The major function of these inspections are an overall review of the handler's performance (MPCA, 1996b). This finding may be the result of the MPCA attempting to educate VSQGs through thorough on-site inspections; in this instance, these all-encompassing inspections have not led to more penalties for VSQGs.

Next, VSQGs were significantly more likely to have violations than SQGs or LQGs, with NOVs being the violation most frequently issued. These findings are departures from the original hypotheses, but would logically follow since VSQGs were more likely to have inspections and had significantly more of them. Historically, VSQGs have not been enforced the same way as their SQG or LQG counterparts. First, there were simply too many of them to monitor. Second, SQGs were less likely to have money to pay for corrective actions, etc. This change could be the result of political factors such as citizen pressure to enforce environmental laws more stringently, the desire to have a "good business climate" in Minnesota or the realization of enforcement authorities that VSQGs should be held to the same standards as larger quantity generators.

Finally, LQGs had significantly more penalty actions than VSQGs. This finding is inconsistent with the previously mentioned results. It would logically follow that VSQGs would suffer more penalty actions and larger penalty amounts than either of the other classes of generators since they were inspected more often and receive more violations than the other classes. It appears that smaller quantity generators were not held to the same standards as their larger quantity counterparts, even though all types of hazardous waste generators, regardless of size, were governed by the same laws and rules (with minor variations). This disparity could be due, in part, to the industry most represented by VSQGs, agriculture. Agricultural-related industry has been the backbone of Minnesota's economy for many years with small family farms comprising a large part of this category. It goes without saying that the MPCA would not want to scrutinize these small family-owned operations (which had a lot at stake). Today these farms were being noticed by the MPCA which is evidenced by the number of inspections and violations, but are not being penalized in the same manner as their LQG, metro-area colleagues. Maybe, as was mentioned in an earlier hypothesis, these standard-bearing, metro area LQGs were being made an example of again.

CONCLUSIONS AND RECOMMENDATIONS

Conclusions

Three key issues surfaced as a result of this research: the disparity between inspected VSQGs and the other sizes of hazardous waste generators; the organization/structure of regulatory enforcement in Minnesota and the MPCA's poorly managed database.

The overall impression left of regulatory enforcement was one of uneven and inconsistent administration of inspections, violations and penalties amongst the different sizes of hazardous waste generators in Minnesota. The above discussion pointed out how VSQGs were more likely to have inspections and violations, but less likely to be penalized. This may be indicative of the MPCA exercising more tolerance and a willingness to educate smaller quantity generators in greater Minnesota counties. Another explanation that seems reasonable concerns the enforcement structure in Minnesota. The MPCA has delegated a great deal of enforcement authority in the seven county metro area to the counties themselves, especially Hennepin and Ramsey counties which have staff dedicated to monitoring hazardous waste generators. The MPCA has focused more of its attention on greater Minnesota counties. As a whole, greater Minnesota counties have fewer enforcement/educational resources when dealing with hazardous waste generators. The result of this could be two different standards being used to evaluate practices/procedures amongst the varying sizes of hazardous waste generators. This, however, would be difficult to say without comparable county data.

The MPCA's ability to identify, track, research and educate hazardous waste generators is substantially weakened by its poorly managed data. Database communication between the MPCA and metro county enforcement personnel is nearly non-existent. In other words, if a company receives an inspection, violation or enforcement action from the county enforcement personnel, it may not show up in the MPCA's database (HWIMS). This, however, may be indicative of a larger problem--lack of guidance/poor guidance from the Environmental Protection Agency (EPA). The EPA establishes reporting standards and protocol for state agencies such as the MPCA.

Recommendations

It was initially the hope of the author to include more variables and run more sophisticated statistical analyses, but this was limited due to a modest number of variables and cases in the HWIMS database.

Disparities. The MPCA and county must address the disparity between VSQGs and other classifications of hazardous waste generators. One course of action, regardless of political consequences, would be to spend less energy educating smaller quantity generators and penalize them more. The converse of this would be to spend more time educating larger quantity generators rather than penalizing them. This is only one of the problems, however.

Enforcement structure. Next, the MPCA and legislators need to examine the current regulatory enforcement structure for environmental offenders; right now regulatory enforcement is decentralized. First, the MPCA could hire more investigators and place them into metro county enforcement offices. Second, county personnel could be eliminated altogether and more personnel hired at the MPCA. Third, and finally, there could be more training between MPCA and county enforcement personnel. The desired end-state for all of these proposals would be more consistent enforcement by both MPCA and county personnel.

Database management. Next, database management needs to be examined. State and county personnel should utilize the same software and database management system. Information flow (as it pertains to inspections, violations and penalties) should be bi-directional and centralized. As it stands now, information is held in many different databases and needs to be linked together to create a single report. It should be noted at this point, the MPCA is undergoing a change in its computer system. This new computer initiative described in the MPCA's 1996 Self-Assessment, known as the DELTA Project, is supposed to enhance their capabilities in managing current and future data.

The current research needs to be interpreted with caution due to the shortfalls mentioned. Additionally, research pertaining to hazardous waste generators needs to be taken further. First, specific companies could be examined internally to develop correlations between individual industry and the current research variables. Further, the

MPCA could implement any of the above recommendations and then track them using the variables from this study. Above all, the MPCA needs to conduct more quantitative research and implement changes/initiatives based on the results.

Implications. The implications of this research for education and enforcement are sobering. The MPCA now knows that VSQGs are more likely to be violators of hazardous waste laws. With this in mind, the MPCA and other enforcement personnel in Minnesota must take a more aggressive approach to enforcing hazardous waste laws; this could mean increasing the number of inspections per year for education purposes, discarding the notion that Minnesota is more "business friendly" than "environmentally friendly" or referring more cases for criminal prosecution to "make an example" of violators.

The bottom line, regardless of generator size, is preventing hazardous waste from entering Minnesota's environment. Whether the waste involved is 10 kg for a VSQG or 1000 kg for a LQG is irrelevant: animals, humans and the environment will continue to suffer. These deaths will occur slowly; it is the hope of the author that the attitudes of Minnesota's citizens, businesses and enforcement personnel will not.

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APPENDICES

APPENDIX A

Hazardous Waste Generator Data Collection Outline

Hazardous Waste Generator Data Collection Outline

DEMOGRAPHICS

0. EPA ID #________________

1. Year

   a. ____1994, b.____1995, c.____1996

2. Generator Size

   a.____Very Small Quantity Generator (VSQG)
   b.____ Small Quantity Generator (SQG)
   c.____ Large Quantity Generator (LQG)

3. County

   a.____Metro (Anoka, Carver, Dakota, Hennepin, Ramsey, Washington and Wright)
   b.____Greater Minnesota (All others)

4. Industry Type (SIC Code)

   a.____Agriculture
   b.____Manufacturing
   c.____Transportation
   d.____Services
   e.____Trade
   f.____Other

INSPECTIONS

5. Has the generator had an inspection?

   a.____Yes (Continue)
   b.____No (End survey)

6. Total number of inspections ________.

7. First type of inspection.
   a.____Compliance Evaluation Inspection (CEI)
   b.____Compliance Monitoring Evaluation (CME)
   c.____Financial Record Review (FRR)
   d.____Non-financial Record Review (NRR)
   e.____Operation and Maintenance Inspection (OAM)
   f.____Sampling Inspection (SPL)
   g.____Other (OTH)

8. Inspection reason (first inspection).
   a.____Original
   b.____Follow up

VIOLATIONS

9. Generator have violations?
   a.____Yes (Continue)
   b.____No (End survey)

10. Number of violations ________.

11. Type of first violation.
   a.____General Requirements (GGR)
   b.____Manifest Requirements (GMR)
   c.____Pre-transport Requirements (GPT)
   d.____Recordkeeping Requirements (GRR)
   e.____Special Conditions (GSC)
   f.____Small Quantity Requirements (GSQ)
   g.____General Land Ban (GLB)
   h.____Other (GOR)

12. Class of violations.
    a.____Class I
    b.____Class II

13. Priority of violations (1-Low thru 9-High) ___________.

14. Type of first enforcement action.
    a.____Notice of Violation
    b.____Forgivable Administrative Penalty Order
    c.____Non-forgivable Administrative Penalty Order
    d.____Forgivable & Non-forgivable Administrative Penalty Order
    e.____Executed Stipulation Agreement

PENALTIES

15. Generator issued a penalty (fine)?
    a.____Yes (Continue)
    b.____No (End survey)

16. Number of penalty actions ___________.

17. Total amount of penalties ___________.

Key:
col, cols = column(s)
V = variable

APPENDIX B

Hazardous Waste Generator Data Collection Outline Coding Scheme

Hazardous Waste Generator Data Collection Outline
Coding Scheme

DEMOGRAPHICS

0. EPA ID #________________ *(V01; cols 1-7)*

1. Year *(V02, col 8)*

   a. *(1)* 1994, b. *(2)* 1995, c. *(3)* 1996

2. Generator Size *(V03, col 9)*

   a. *(1)* Very Small Quantity Generator (VSQG)
   b. *(2)* Small Quantity Generator (SQG)
   c. *(3)* Large Quantity Generator (LQG)

3 County *(V04, col 10)*
   a. *(1)* Metro (Anoka, Carver, Dakota, Hennepin, Ramsey, Washington and Wright)
   b. *(2)* Greater Minnesota (All others)

4. Industry Type (SIC Code) *(V05, col 11)*
   a. *(1)* Agriculture
   b. *(2)* Manufacturing
   c. *(3)* Transportation
   d. *(4)* Services
   e. *(5)* Trade
   f. *(6)* Other

INSPECTIONS

5. Has the generator had an inspection? *(V06, col 12)*
   a. *(1)* Yes (Continue)
   b. *(2)* No (End survey)

6. Total number of inspections ________. *(V07, cols 13-14)*

7. First type of inspection. *(V08, col 15)*
    a. *(1)* Compliance Evaluation Inspection (CEI)
    b. *(2)* Compliance Monitoring Evaluation (CME)
    c. *(3)* Financial Record Review (FRR)
    d. *(4)* Non-financial Record Review (NRR)
    e. *(5)* Operation and Maintenance Inspection (OAM)
    f. *(6)* Sampling Inspection (SPL)
    g. *(7)* Other (OTH)

8. Inspection reason (first inspection). *(V09, col 16)*
    a. *(1)* Original
    b. *(2)* Follow up

VIOLATIONS

9. Generator have violations? *(V10, col 17)*
    a. *(1)* Yes (Continue)
    b. *(2)* No (End survey)

10. Number of violations __________. *(V11, cols 18-19)*

11. Number of each type of violation.
    (*V12, cols 20-21)* a._General Requirements (GGR)
    (*V12a, cols 22-23*) b._Manifest Requirements (GMR)
    (*V12b, cols 24-25*) c._Pre-transport Requirements (GPT)
    (*V12c, cols 26-27*) d._Recordkeeping Requirements (GRR)
    (*V12d, cols 28-29*) e._ Special Conditions (GSC)
    (*V12e, cols 30-31*) f._Small Quanitity Requirements (GSQ)
    (*V12f, cols 32-33*) g._General Land Ban (GLB)
    (*V12g, cols 34-35*) h._Other (GOR)

12. Class of violations. *(V13, col 36)*
    a. *(1)* Class I
    b. *(2)* Class II

13. Priority of violations (1-Low thru 9-High) ____________. *(V14, col 37)*

14. Type of first enforcement action. *(V15, col 38)*
    a. *(1)* Notice of Violation
    b. *(2)* Forgivable Administrative Penalty Order
    c. *(3)* Non-forgivable Administrative Penalty Order
    d. *(4)* Forgivable & Non-forgivable Administrative Penalty Order
    e. *(5)* Executed Stipulation Agreement

PENALTIES

15. Generator issued a penalty (fine)? *(V16, col 39)*
    a. *(1)* Yes (Continue)
    b. *(2)* No (End survey)

16. Number of penalty actions __________. *(V17, cols 40-41)*

17. Total amount of penalties __________. *(V18, cols 42-43)*

Key:
col, cols = column(s)
V = variable

APPENDIX C

HWIMS Merged Data Sheet

VO1	VO2	VO3	VO4	VO5	VO6	VO7	VO8	VO9
MNR000010	3	1	2		1	1	1	1
MND985765	3	1	2	1	1	1	1	1
MND985723	1	1	1		1	2	8	1
MND985673	2	1	2	1	1	1	1	1
MN0000201	1	1	2	5	1	1	8	1
MND006166	1	1	2	2	1	3	1	1
MND981952	1	1	2	2	1	4	1	1
MND9682210	2	1	2	1	1	5	1	1
MND985683	1	1	2	1	1	3	1	1
MND985718	1	1	2	1	1	1	1	1

V10	V11	V12A	V12B	V12C	V12D	V12E	V12F	V12G
2								
2								
1	10	4	1	4				
1	6			6				
2								
2								
1	4		2	2				
2								
1	1							
1	10	1	1	6	2			

V12H	V13	V14	V15	V16	V17	V18
	1	7	213	2		
	2	5		2		
	2	3		2		
1	2	3		2		
	2	5		2		
	2	5		2		

APPENDIX D

Breakout of Major Standard Industrial Classification (SIC) Categories

Breakout of Major SIC Categories (collapsing scheme)

SIC Category One (Agriculture):
Agricultural (farming); fishing; forestry; hunting, trapping

SIC Category Two (Manufacturing):
Printing/publishing; furniture repair; food and kindred industries; textile/mill products; lumber/wood products; furniture and fixtures; paper and allied products; chemicals and allied products; petroleum and refining; rubber and miscellaneous plastics; leather and leather products; stone, clay and glass industry; primary metal industries; industrial and commercial machinery; electronic and other electrical equipment; transportation equipment; and miscellaneous manufacturing

SIC Category Three (Transportation/Communication):
Railroads; airports; petroleum; electric and gas services; transportation (generally); and communication (generally)

SIC Category Four (Services):
Personal services, laundering; automobile repair; miscellaneous repair

SIC Category Five (Trade):
Wholesale trade (food stores and wholesale non-durables); wholesale durables; retail trade (automobile dealers, equipment stores, and retail stores) ; and special trade

SIC Category Six (Other):
Metal/mining; heavy construction; construction; finance and insurance; public administration

APPENDIX E

F and K Lists of Hazardous Wastes

Minnesota Pollution Control Agency

F LIST OF HAZARDOUS WASTES

The F list contains hazardous waste from nonspecific sources.** This means the waste comes from different processes or sources within a certain industry or different industries. **The F list is found in the Minnesota Hazardous Waste Rules pt. 7045.0135 subp. 2. Waste on this list is hazardous for one or more of these reasons:

- it is ignitable (I),
- it displays a toxicity characteristic (E),
- it is corrosive (C),
- it is acutely hazardous (H),
- it is reactive (R), or
- it is toxic (T).

In this fact sheet

Hazardous Waste Codes

Each waste on this list is assigned a hazardous waste code or number which precedes the name of the waste and must be used in reporting, record keeping and manifesting. The F list includes spent solvents (waste codes F001-F005) and wastes from electroplating and manufacturing processes (waste codes F006-F027). The hazard code given in parentheses after the listing indicates why each waste appears on this list.

F001 These spent halogenated solvents used in degreasing
- carbon tetrachloride;
- chlorinated fluorocarbons;
- methylene chloride;
- tetrachloroethylene;
- 1,1,1-trichloroethane;
- trichloroethylene; and,
- all spent solvent mixtures/blends used in degreasing containing, before use, a total of ten percent or more by volume of one or more of the above halogenated solvents or those solvents listed in F002, F004, and F005; and
- still bottoms from the recovery of these spent solvents and spent solvent mixtures: (T).

F002 These spent halogenated solvents:
- chlorobenzene;
- methylene chloride;
- orthodichlorobenzene;
- tetrachloroethylene;
- 1,1,1-trichloroethane;
- 1,1,2-trichloroethane;
- trichloroethylene;
- trichlorofluoromethane;
- 1,1,2-trichloro-1,2,2-trifluoroethane; and,
- all spent solvent mixtures/blends containing, before use, a total of ten percent or more by volume of one or more of the above halogenated solvents or those solvents listed in F001, F004 and F005; and
- the still bottoms from the recovery of these spent solvents and spent solvent mixtures: (T).

F003 These spent nonhalogenated solvents:
- acetone;
- cyclohexanone;
- ethyl acetate;
- ethyl benzene;
- ethyl ether;
- methanol;
- methyl isobutyl ketone;
- n-butyl alcohol;
- xylene; and
- all spent solvent mixtures/blends containing, before use, only the above spent nonhalogenated solvents; and
- all spent solvent mixtures/blends, containing, before use, one or more of the above non-halogenated

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solvents and a total of ten percent or more by volume of one or more of those solvents listed in F001, F002, F004 and F005; and
- the still bottoms from the recovery of these spent solvents and spent solvent mixtures: (I).

F004 These spent non-halogenated solvents:
- cresols and cresylic acid;
- nitrobenzene; and
- all spent solvent mixtures/blends containing, before use, a total of ten percent or more by volume of one or more of the above nonhalogenated solvents of those solvents listed in F001, F002 and F005; and
- the still bottoms from the recovery of these spent solvents and spent solvent mixtures: (T).

F005 These spent non-halogenated solvents:
- benzene;
- carbon disulfide;
- 2-ethoxyethanol;
- isobutanol;
- methyl ethyl ketone;
- 2-nitropropane;
- pyridine;
- toluene; and
- all spent solvent mixtures/blends containing, before use, a total of ten percent or more by volume of one or more of the above nonhalogenated solvents or those solvents listed in F001, F002 and F004; and
- the still bottoms from the recovery of these spent solvents and spent solvent mixtures: (I,T).

F006 Wastewater treatment sludges from electroplating operations *except* from these processes:
- sulfuric acid anodizing of aluminum;
- tin plating on carbon steel;
- zinc plating (segregated basis) on carbon steel;
- aluminum or zinc aluminum plating on carbon steel;
- cleaning/stripping associated with tin, zinc and aluminum plating on carbon steel; and
- chemical etching and milling of aluminum: (T).

F007 Spent cyanide plating bath solutions from electroplating operations: (R,T).

F008 Plating bath sludges from the bottom of plating baths from electroplating operations where cyanides are used in the process: (R,T).

F009 Spent stripping and cleaning bath solutions from electroplating operations where cyanides are used in the process: (R,T).

F010 Quenching bath residues from oil baths from metal heat treating operations where cyanides are used in the process: (R,T).

F011 Spent cyanide solutions from salt bath pot cleaning from metal heat-treating operations: (R,T).

F012 Quenching wastewater treatment sludges from metal heat-treating operations where cyanides are used in the process: (T).

F019 Wastewater treatment sludges from the chemical conversion coating of aluminum: (T).

F020 Wastes, except wastewater and spent carbon from hydrogen chloride purification, from the production or manufacturing use as a reactant, chemical intermediate, or component in a formulating process of tri- or tetrachlorophenol, or of intermediates used to produce their pesticide derivatives. This listing does not include wastes from the production of hexachlorophene from highly purified 2,4,5- trichlorophenol: (H).

F021 Wastes, except wastewater and spent carbon from hydrogen chloride purification, from the production or manufacturing use as a reactant, chemical intermediate or component in a formulating process of pentachlorophenol or of intermediates used to produce its derivatives: (H).

F022 Wastes, except wastewater and spent carbon from hydrogen chloride purification, from the manufacturing use as a reactant, chemical intermediate or component in a formulating process of tetra-, penta-, or hexachlorobenzenes under alkaline conditions: (H).

F023 Wastes, except wastewater and spent carbon from hydrogen chloride purification, from the production of materials on equipment previously used for the production or manufacturing use as a reactant, chemical intermediate or component in a formulating process of *tri- and tetra-chlorophenols. This listing* does not include wastes from equipment used only for the production or use of hexachlorophene from highly purified 2,4,5- trichlorophenol: (H).

F024 Wastes, including but not limited to, distillation residues, heavy ends, tars and reactor cleanout wastes from the production of chlorinated aliphatic hydrocarbons, having carbon content from one to five, utilizing free-radical catalyzed processes. This does not include light ends, spent filters and filter aids, spent dessicants, wastewater, wastewater treatment sludges and spent catalysts: (T).

F026 Wastes except wastewater and spent carbon from hydrogen chloride purification, from the production of materials on equipment previously used for the manufacturing use as a reactant, chemical intermediate, or component in a formulating process of tetra-, penta-, or hexachlorobenzene under alkaline conditions: (H).

F027 Discarded unused formulations containing tri-, tetra-, pentachlorophenol or discarded unused formulations containing compounds derived from these chlorophenols. This listing does not include formulations containing hexachlorophene synthesized from prepurified 2,4,5-trichlorophenol as the sole component: (H).

F028 Residues resulting from the incineration or thermal treatment of soil contaminated with hazardous waste numbers F020, F021, F022, F023, F026 and F027: (T).

Note: F020, F021, F022, F023, F026 and F027 are acute hazardous wastes. Special size calculations, accumulation limits and empty-container management methods apply. Contact your metro county hazardous waste officer or the Minnesota Pollution Control Agency central or regional offices for more information.

Metropolitan County Hazardous Waste Offices

- Anoka County............ 612/ 421-7063
- Carver County............ 612/ 361-1800
- Dakota County........... 612/ 891-7011
- Hennepin County....... 612/ 348-8100
- Ramsey County......... 612/ 773-4466
- Scott County.............. 612/ 496-8473
- Washington County... 612/ 430-6655

Minnesota Pollution Control Agency

- Main Switchboard..... 612/ 296-6330
  800/ 657-3864
- TTY Users................. 612/ 282-5332
  800/ 657-3864
- Business Assistance Unit........................ 612/ 297-8363
  800/ 657-3724
- Brainerd Region........ 218/ 828-2492
- Detroit Lakes Region 218/ 847-1519
- Duluth Region........... 218/ 723-4660
- Marshall Region........ 507/ 537-7146
- Rochester Region...... 507/ 285-7343

NOTE: All MPCA regional offices may be reached by using the main switchboard 800 number and requesting the desired regional office.

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Hazardous Waste Division, 520 Lafayette Road North St. Paul, Minnesota 55155
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Minnesota
Pollution
Control
Agency

K LIST OF HAZARDOUS WASTE

The K list consists of hazardous waste from specific sources (waste comes from a specific process or source within a certain industry). The K list is found in the Minnesota Hazardous Waste Rules pt. 7045.0135 subp. 3. Waste on this list is hazarous for one of these reasons:

- *it is ignitable (I);*
- *it is corrosive (C);*
- *it is reactive (R);*
- *it displays a toxicity characteristic (E); or,*
- *it is toxic (T).*

In this fact sheet

About the K List

The K list includes no acute hazardous waste. Each listed hazardous waste is assigned a hazardous waste number or code which precedes the name of the waste and must be used in reporting, record keeping and manifesting. Hazardous wastes from specific sources are listed by industry and hazardous waste number. The reason each waste appears on this list can be determined by the hazard code given in parentheses at the end of the listing.

A. Wood preservation:

K001 Bottom sediment sludge fm the treatment of wastewaters from wood-preserving processes that use creosote and/or pentachlorophenol: (T).

B. Inorganic pigments:

K002 Wastewater treatment sludge from the production of chrome yellow and orange pigments: (T).

K003 Wastewater treatment sludge from the production of molybdate orange pigments: (T).

K004 Wastewater treatment sludge from the production of zinc yellow pigments: (T).

K005 Wastewater treatment sludge from the production of chrome green pigments: (T).

K006 Wastewater treatment sludge from the production of chrome oxide green pigments, anhydrous and hydrated: (T)

K007 Wastewater treatment sludge from the production of iron blue pigments: (T).

K008 Oven residue from the production of chrome oxide green pigments: (T).

C. Organic chemicals:

K009 Distillation bottoms from the production of acetaldehyde from ethylene: (T).

K010 Distillation side cuts from the production of acetaldehyde from ethylene. (T).

K011 Bottom stream from the wastewater stripperin the production of acrylonitrile: (R,T).

K013 Bottom stream from the acetonitrile column in the production of acrylonitrile: (R,T).

K014 Bottoms from the acetonitrile purification column in the production of acrylonitrile: (T).

K015 Still bottoms from the distillation of benzyl chloride: (T).

K016 Heavy ends or distillation residues from the production of carbon tetrachloride: (T).

K017 Heavy ends (still bottoms) from the purification column in the production of epichloro hydrin: (T).

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(612) 296-6300, TDD (612) 282-5332, toll-free (800) 657-3864

K018 Heavy ends from the fractionation column in ethyl chloride production: (T).

K019 Heavy ends from the distillation of ethylene dichloride in ethylene dichloride production: (T).

K020 Heavy ends from the distillation of vinyl chloride in vinyl chloride monomer production: (T).

K021 Aqueous spent antimony catalyst waste from fluoromethane production: (T).

K022 Distillation bottom tars from the production of phenol/acetone from cumene: (T).

K023 Distillation light ends from the production of phthalic anhydride from naphthalene: (T).

K024 Distillation bottoms from the production of phthalic anhydride from naphthalene: (T).

K093 Distillation light ends from the production of phthalic anhydride from ortho-xylene: (T).

K094 Distillation bottoms from the production of phthalic anhydride from ortho-xylene: (T).

K025 Distillation bottoms from the production of nitrobenzene by the nitration of benzene: (T).

K026 Stripping still tails from the production of methyl ethyl pyridines: (T).

K027 Centrifuge and distillation residues from toluene diisocyanate production: (R,T).

K028 Spent catalyst from the hydrochlorinator reactor in the production of 1,1,1-trichloroethane: (T).

K029 Waste from the product steam stripper in production of 1,1,1-trichloroethane: (T).

K095 Distillation bottoms from the production of 1,1,1-trichloroethane: (T).

K096 Heavy ends from the heavy ends column from *the production of 1,1,1-trichloroethane:* (T).

K030 Column bottoms or heavy ends from the combined production of trichloroethylene and tetrachloroethylene: (T).

K083 Distillation bottoms from aniline production: (T).

K103 Process residues from aniline extraction from the production of aniline: (T).

K104 Combined wastewater streams generated from nitrobenzene/aniline production: (T).

K085 Distillation or fractionation column bottoms from the production of chlorobenzenes: (T).

K105 Separated aqueous stream from the reactor product-washing step in the production of chlorobenzenes: (T).

K111 Product wash waters from the prodution of dinitrotoluene via nitration of toluene: (C,T).

K112 Reaction byproduct water from the drying column in the production of toluenediamine via hydrogenation of dinitrotoluene: (T).

K113 Condensed liquid light ends from the purification of toluenediamine in the production of toluenediamine via hydrogenation of dinitrotoluene: (T).

K114 Vicinals from the purification of toluenediamine in the production of toluenediamine via hydrogenation of dinitrotoluene: (T).

K115 Heavy ends from the purifiction of toluenediamine in the production of toluenediamine via hydrogenation of dinitrotoluene: (T).

K116 Organic condensate from the solvent-recovery column in the production of toluene diisocyanate via phosgenation of toluenediamine: (T).

K117 Wastewater from the reactor vent gas scrubber in the production of ethylene dibromide via bromination of ethene: (T).

K118 Spent adsorbent solids from purification of ethylene dibromide in the production of ethylene dibromide via bromination of ethene: (T).

K136 Still bottoms from the purification of ethylene dibromide in the production of ethylene dibromide via bromination of ethene: (T)..

D. Inorganic chemicals:

K071 *Brine purification muds from the mercury* cell process in chlorine production, when separately prepurified brine is not used: (T).

K073 Chlorinated hydrocarbon waste from the purification step of the diaphragm cell process using graphite anodes in chlorine production: (T).

K106 Wastewater treatment sludge from the mercury cell proess in chlorine production: (T).

E. Pesticides:

K031 Byproduct salts generated in the production of monosodium methanearsonate (MSMA) and cacodylic acid: (T).

K032 Wastewater treatment sludge from the production of chlordane: (T)

K033 Wastewater and scrub water from the chlorination of cyclopentadienein the production of chlordane: (T).

K034 Filter solids from the filtration of hexachlorocyclopentadiene in the production of chlordane: (T).

K097 Vacuum stripper discharge from the chlordane chlorinator in the production of chlordane: (T).

K035 Wastewater treatment sludges generated in the production of creosote: (T).

K036 Still bottoms from toluene reclamation distillation in the production of disulfoton: (T).

K037 Wastewater treatment sludges from the production of disulfoton: (T).

K038 Wastewater from the washing and stripping of phorate production: (T).

K039 Filter cake from the filtration of diethylphosphorodithioic acid in the production of phorate: (T).

K040 Wastewater treatment sludge from the production of phorate: (T).

K041 Wastewater treatment sludge from the production of toxaphene: (T).

K098 Untreated process wastewater from the production of toxaphene: (T).

K042 Heavy ends or distillation residues from the distillation of tetrachlorobenzene in the production of 2,4,5-T: (T).

K043 2,6-dichlorophenol waste from the production of 2,4-D: (T).

K099 Untreated wastewater from the production of 2,4-D: (T).

K123 Process wastewater (including supernates, filtrates and wash wates) from the production of ethylenebisdithiocarbamic acid and its salts: (T).

K124 Reactor vent-scrubber water from the production of ethylenebisdithiocarbamic acid and its salts: (C,T).

K125 Filtration, evaporation and centrifugation solids from the production of ethylenebisdithiocarbamic acid and its salts: (T).

K126 Bag-house dust and floor sweepings in milling and packaging operations from the production or formulation of ethylenebisdithiocarbamic acid and its salts: (T).

F. Explosives:

K044 Wastewater treatment sludges from the manufacturing and processing of explosives: (R).

K045 Spent carbon from the treatment of wastewater containing explosives: (R).

K046 Wastewater treatment sludges from the manufacturing, formulation and loading of lead-based initiating compounds: (T).

K047 Pink/red water from operations involving 2,4,6-trinitrotoluene (TNT): (R).

G. Petroleum refining:

K048 Dissolved air flotation (DAF) float from the petroleum-refining industry: (T).

K049 Slop-oil emulsionsolids from the petroleum-refining industry: (T).

K050 Heat-exchanger bundle-cleaning sludge from the petroleum-refining industry: (T).

K051 American Petroleum Institute separator sludge from the petroleum-refining industry as specified in *The Manual on Disposal of Refinery Wastes, volume 1*, issued by the American Petroleum Institute (Washington, D.C., 1969), available at the State of Minnesota Law Library: (T).

K052 Tank bottoms (leaded) from the petroleum-refinery industry: (T).

H. Iron and steel:

K061 Emission-control dust or sludge from the primary production of steel in electric furnaces: (T).

K062 Spent pickle liquor generated by steel-finishing operations of facilities within the iron and steel industry that are classified as number 331 or 332 facilities under the *Standard Industrial Classification Manual:* (C,T) (1972), which is incorporated by reference. This document is prepared and issued by the Executive Office of the President, Office of Management and Budget, Statistical Policy Division. It is not subject to frequent change. It is available through the Minitex interlibrary loan system.

I. Primary copper:

K064 Acid-plant blowdown slurry or sludge resulting from the thickening of blowdown slurry from primary copper production: (T).

J. Primary lead:

K065 Surface impoundment solids contained in and dredged from surface impoundments at primary lead-smelting facilities: (T).

K. Primary zinc:

K066 Sludge from treatment of process wastewater and/or acid plant blowdown from primary zinc production: (T)

L. Primary aluminum:

K088 Spent potliners from primary aluminum reduction: (T).

M. Ferroalloys:

K090 Emission-control dust or sludge from ferrochromiumsilicon production: (T).

K091 Emission-control dust or sludge from ferrochromium production: (T).

N. Secondary lead:

K069 Emission control dust or sludge from secondary lead smelting: (T).

K100 Waste leaching solution from acid leaching of emission-control dust or sludge from secondary lead smeling: (T).

O. Veterinary pharmaceuticals:

K084 Wastewater-treatment sludges generated during the production of veterinary pharmaceuticals from arsenic or organo arsenic compounds: (T).

K101 Distillation tar residues from the distillation of aniline-based compounds in the production of veterinary pharmaceuticals from arsenic or organo arsenic compounds: (T).

K102 Residue from the use of activated carbon for decolorization in the production of veterinary pharmaceuticals from arsenic or organo arsenic compounds: (T).

P. Ink formulation:

K086 Solvent washes and sludges, caustic washes and sludges or water washes and sludges from cleaning tubs and equipment used in the formulation of ink from pigments, dryers, soaps and stabilizers containing chromium and lead: (T).

Q. Coke:

K060 Ammonia still lime sludge from coking operations: (T).

K087 Decanter tank tar sludge from coking operations: (T).

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APPENDIX F

Administrative Penalty Order Forms

STATE OF MINNESOTA
Minnesota Pollution Control Agency

ADMINISTRATIVE PENALTY ORDER

<Company>	Company Status:
<Address>	Inspection Date:
<City>	Inspection Location:
	EPA Identification Number:

This Administrative Penalty Order (Order) is issued pursuant to Minn. Stat. § 116.072 for violation(s) of Minn. Stat. chs. 115, 115A, 115D, 116, or any rules adopted under any of these chapters. You must document to the Commissioner, in writing, that the violations have been corrected or that appropriate steps have been taken to correct the violation(s) within 30 days after receipt of this Order unless you contest the Order. The Commissioner will notify you whether your corrective action is satisfactory. The penalty is due on the 31st day after receipt of this Order unless you contest. Payment is to be made by check or money order payable to the Environmental Response, Compensation and Liability Fund.

• • • • • • • • • • • • •

VIOLATIONS

1. **Minn. Rules pt.**

   ____
   ____
   ____

2. **Minn. Rules pt.**

   ____
   ____
   ____

3. **Minn. Rules pt.**

   ____
   ____
   ____

• • • • • • • • • • • •

CORRECTIVE ACTION REQUIRED

Pursuant to Minn. Stat. § 116.072, subd. 4, you are required to correct all the violations listed in this Order. If you have any questions on the corrective action required, please call the inspector identified below for assistance.

1. ______________________________

. . . . Immediately upon receipt of this Order.

2. ______________________________

. . . . Within 30 days after receipt of this Order.

3. ______________________________

. . . . Within 30 days after receipt of this Order.

* * * * * * * * * * * * *

PENALTY

You are hereby assessed a penalty of $> for the violation(s) cited above. In determining the amount of the penalty, the Commissioner considered the willfulness of the violation(s), the economic benefit gained by the Company, the history of past violations, and the number of violations, and the gravity of the violation(s), including the potential for damage to humans, animals, air, water, land, or other natural resources of the state. <For repeated violation(s), the Commissioner considered similarity to previous violations, time since the last violation, number of previous violations and past response to violations.> Based on the (serious and/or repeated) nature of the violation(s), the Commissioner has determined that the penalty is:

NONFORGIVABLE

* * * * * * * * * * * * *

RIGHT TO REVIEW

You have the right to contest this Order or the determination that your corrective action is unsatisfactory. Within 30 days after receipt of this Order or within 20 days after receipt of the Commissioner's determination that your corrective action is unsatisfactory, you may file a written notice of contest with the Commissioner. An expedited hearing by the Office of Administrative Hearings pursuant to Minn. Stat. ch. 14 will then be scheduled. The Office of Administrative Hearings is an independent administrative judicial agency. You may, instead, file a petition in district court within the same time periods for review of this Order or of the Commissioner's determination that your corrective action is unsatisfactory. The petition must state the specific grounds upon which you challenge this Order. You must send a copy of your petition to Charles W. Williams, Commissioner, Minnesota Pollution Control Agency, a second copy to Kris L. Hulsebus, Special Assistant Attorney General, 520 Lafayette Road North, Suite 200, St. Paul, Minnesota 55155-1699, and file a proof of service on the Commissioner with the clerk of the district court. If your contest is found to be frivolous, you may be required to pay the costs of the contest. Your review rights are more thoroughly described in Minn. Stat. § 116.072, subds. 6 and 7. Please check the law carefully.

Date	**Ann Glumac** **Assistant Commissioner**

CERTIFIED MAIL
RETURN RECEIPT REQUESTED

For further information, please contact:

<inspector>
Minnesota Pollution Control Agency
Regulatory Compliance Section
520 Lafayette Road North
St. Paul, Minnesota 55155-4194
(612) <phone>