

**ACUTE HAZARDOUS EVENTS DATA BASE
EXECUTIVE SUMMARY**

Prepared for

The Office of Toxic Substances
Economics and Technology Division
U.S. Environmental Protection Agency
under
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FORWARD

EPA published criteria for selecting substances on a listing of acutely hazardous substances, as well as a list resulting from the application of those criteria, in December 1983. Guidance documents for making use of the criteria and list were made available at the same time. These materials were published as interim final documents, with opportunity for public review and comment.

The data base that is the subject of this report was developed as a part of the process of establishing the criteria, and information from the data base was used in drafting the published criteria. EPA plans to add other records to the historical profile presented in this interim final report, in order to aid in the validation of the list-making criteria. Current plans are to supplement the current 3,121 records with records from two additional years of data from the National Response Center and from one or more State sources.

ACKNOWLEDGEMENTS

This study was conducted under EPA Contract Number 68-02-4095 by Industrial Economics, Inc.; Management Technology and Data Systems, Inc.; and PEI Associates, Inc. The principal members of the project team were: Dr. James Cummings-Saxton, Ms. Laura Lechner, and Ms. Anna E. Crook (Industrial Economics, Inc.); Dr. Samuel J. Ratick, Mr. Patrick Suckley, and Mr. Stephan Wu (Management Technology and Data Systems, Inc.); and Mr. Thomas K. Corvin, Mr. Edwin A. Pletzing, Mr. E. Radha Krishnan, and Ms. Barbara A. Bruce (PEI Associates, Inc.).

The project team received valuable and generous assistance from individuals in several organizations in acquiring and making use of the data that went into the study. Among these are the EPA Office of Solid Waste and Emergency Response and the Transportation Systems Center of the U.S. Department of Transportation for access to the National Response Center data; EPA's Region 7, for making available its computerized data base; the California Highway Patrol and Office of Emergency Services; the New Jersey Department of Environmental Quality; the Ohio Environmental Protection Agency; and the Texas Air Control Board.

Several EPA employees had active roles in the project. Mr. Frederick W. Talcott was responsible for assembling and coding records from the news media; he was assisted by staff members of the EPA Headquarters Library and the Office of Standards and Regulations. Both Mr. Talcott and Ms. Karen East conducted analytic studies using the data base that have substantially contributed to this report. Mr. James Cottrell of the EPA Office of Toxic Substances, Information Management Division, provided valuable assistance in assigning CAS codes to several hundred listed substances.

We would like to thank the EPA project officers, Mr. Frederick W. Talcott and Mr. Neil Patel, for their active guidance and participation. Overall design and direction was provided by the Analysis Subgroup, led by Mr. Talcott, and including Ms. East, Mr. Patel, and Mr. David Wagner. These individuals and other members of the Acute Hazards List Workgroup provided reviews, comments, and other valuable assistance throughout the study effort.

Copies of this Executive Summary and of the full report, Acute Hazardous Events Data Base (report number EPA 560-S-85-029) are available to the public from the National Technical Information Service, Springfield, Virginia 22161

ACUTE HAZARDOUS EVENTS DATA BASE: EXECUTIVE SUMMARY

The Acute Hazardous Events (AHE) Data Base was assembled as part of EPA's review of the dangers posed to the U.S. public and industrial workers by sudden, accidental releases of toxic chemicals. Concern over such releases was heightened by the tragic incident that occurred on December 3, 1984 in Bhopal, India. EPA formed an Acute Hazards List Workgroup to investigate the safety-related characteristics of U.S. industry with regard to accidental chemical releases that could pose exceptional risks to human health, and to identify the chemicals or situations that appear to represent unusually high risks. In late May 1985, the decision was made to assemble an Acute Hazardous Events Data Base as part of the Acute Hazards List review process.

PURPOSE AND APPROACH

The main purpose of the AHE Data Base is to characterize the kinds of events releasing acutely toxic substances in the U.S., the substances involved, and the causative factors leading to their release. The AHE Data Base provided an historical perspective to members of the Acute Hazards List Workgroup, in order to select criteria for a priority list of acutely hazardous substances. EPA wanted to ensure that the resulting priority list was relevant to recent accident history in the U.S. The AHE Data Base was not constructed to serve as a basis for nation-wide estimates of frequencies of events, quantities released, or their consequences. Emphasis was placed on acquiring a measure of the scope of events, rather than on estimating quantities precisely or frequencies of releases.

An important factor in the AHE Data Base development was the need for it to be assembled quickly in order to support other aspects of the analysis process. Because of the rigorous time constraints, several criteria were employed to screen data for inclusion in the AHE Data Base. Emphasis was placed on incidents

that had acute hazard potential. Incidents that involved death or injury were given highest priority. EPA further directed that priority be given to incidents involving chemicals released into the air. Chemical releases were given priority over petroleum-related and other types of releases. Releases involving large quantities of material were given priority, and events releasing less than one pound of materials were not coded. Incidents involving evacuations also were given priority.

Although the data base includes events of many types and with a wide range of consequences, the AMZ Data Base has been purposely biased (through these data collection criteria) toward events considered to have the greatest potential for sudden, large-scale harm to the populace. Thus, the summary statistics obtained from the data base are not reflective of the totality of potentially hazardous domestic materials.

DATA SOURCES AND COVERAGE

The data base contains 3,121 records which, through sampling, represent 6,928 separate events. The records came from thirteen public sources chosen because of their accessibility, their potential to yield a large number of events meeting the selection criteria described above, and their geographic coverage. The events occurred mostly from 1980 to mid-1985, with 1983 and 1984 most heavily represented.

One nation-wide government source, the National Response Center, contributed 1,225 records. A multi-state regional source, EPA's Region 7, provided 513 records. Five offices of four state governments were the source of 1,029 records. Four daily newspapers and one wire service contributed 290 records. Finally, 64 records were obtained from a summary prepared by an engineering consulting firm specializing in industrial accidents. See Exhibit A.

EVENTS WITH INJURIES OR DEATHS

Human casualties occurred in fewer than seven percent of the recorded events. These events -- a total of 468 -- led to 138 deaths and 4,717 injuries, ranging in severity from temporary respiratory problems treated on-site to critical injuries and extended hospitalizations. Information on causation was scanty in most records. See Exhibit B.

Four high-volume industrial inorganic chemicals (chlorine, ammonia, hydrochloric acid and sulfuric acid) together were reported to have been released in over 25 percent of the events recording human casualties. See Exhibit C. More than 200

additional identifiable substances were recorded as released during events associated with deaths or injuries, with industrial organic chemicals, as a class, contributing the largest number of events with human casualties. See Exhibit D. At least another 200 substances were recorded as being released in events not resulting in deaths or injuries.

Events reported with human casualties included some with very large quantities and some with very small quantities released. See Exhibit E. Similarly, the inherent toxicity of the substances released need not necessarily be particularly high for deaths or injuries to have occurred. Exhibit F illustrates this, showing that as many events were recorded with substances in the two least toxic Reportable Quantity categories (i.e. RQ = 3,000 pounds and 1,000 pounds) as were recorded for the two most toxic categories (i.e. RQ = 1 pound and 10 pounds.) When the characteristics of the released substances are examined, toxicity appears to be the cause of most of the injuries recorded, while flammability and explosivity are the mechanisms associated with most of the fatalities in the data base. See Exhibit G.

Transportation releases account for 25 percent of all events in the data base, and a somewhat higher percent of death or injury events (33 percent.) See Exhibit H. Trucks are the predominant mode of transport in the death and injury events. Among events with human casualties at fixed facilities, storage vessels play a much larger role as release points than they do among events not leading to deaths or injuries.

When viewed from an industry perspective, the Chemicals and Allied Products and the Petroleum Refining industries together account for 34 percent of the reported injuries, and more than half of the reported deaths. The transportation industries account for 16 percent of the reported injuries and about one-fourth of the reported deaths. Industries or vendors that use or store chemical or fuel products account for about 25 percent of the deaths and injuries. See Exhibits I and J.

OTHER EFFECTS

Information on evacuations, property damage and environmental damage was seldom provided in the records examined. In records furnishing such information, evacuations totaled more than 217,000 individuals, with one event accounting for an estimated 20,000 evacuated people. Information on environmental and property damage was usually expressed in vague terms. However, one source reported 64 large-scale industrial accidents (over a 28 year period) having an average estimated economic cost of \$30 million each (in 1984 dollars), with one event resulting in more than \$100 million in estimated damages. See Exhibit K.

QUANTITIES RELEASED AND ASSOCIATED FACTORS

Eighty percent of the events reported a quantity for the material released, and the amount ranges from a few pounds to well over 100,000 pounds. See Exhibit L. Amount released exceeds 1,000 pounds for over 38 percent of the recorded events. Releases over 100,000 pounds occur in less than three percent of the events, but these events account for 93 percent of the total quantity of materials released. The total quantity reported released for all events exceeds 420 million pounds.

Over 80 percent of the events in the data base reported that at least one of the substances released was a liquid; 18 percent of the events involved the release of a gas; and 3 percent of the events involved the release of a solid.

Among events occurring at fixed facilities, spills are the predominant and effect, followed by vapor releases, fires, and explosions. Storage vessels, process vessels, and valves or piping are responsible for nearly equal shares of in-plant events, (see Exhibit M) but storage vessels typically release much larger quantities than the other release points in a plant. Equipment failure is the cause most frequently reported for in-plant events, followed by operator error. See Exhibit N. Accident causes are difficult to assess for many of the events in the data base, however.

Over half of the in-transit events involve trucks, and another 36 percent involve rail cars. See Exhibit O. Over 38 percent of the in-transit releases stem from a leak, and another 20 percent from collisions. See Exhibit P. Although few events were reported for pipelines, those spills dwarf other in-transit releases in terms of total quantity released.

EXHIBIT A

DISTRIBUTION OF EVENTS BY SOURCE AND YEAR

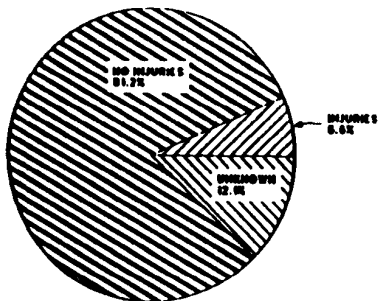
Source	Before						First	
	1980	1981	1982	1983	1984	1985	Half	Total
National Response Center	--	--	--	--	539	679	7	1229
United Press International	--	--	--	1	56	48	34	139
Marsh & McLennan	48	5	1	3	4	3	--	64
EPA Region 7	1	1	101	144	108	107	51	513
Newspapers:								
Los Angeles Times	1	5	8	10	3	1	--	28
New Orleans Times-Picayune	--	31	34	--	--	--	--	65
Chicago Tribune	--	7	5	--	--	--	--	12
New York Times	--	10	19	12	4	1	--	46
Subtotal	1	53	66	22	7	2	0	151
States:								
Calif. Office of Emergency Services	--	--	--	--	--	119	22	141
California Highway Patrol	--	--	--	--	32	32	3	67
Texas Air Control Board	--	19	66	64	57	127	109	442
Ohio EPA	--	--	1	77	59	103	23	263
New Jersey Department of Environmental Quality	--	--	--	1	46	36	33	116
Subtotal	0	19	67	142	194	417	190	1,029
TOTAL	90	78	235	312	908	1,256	282	3,121

EXHIBIT B

ACUTE HAZARDOUS EVENTS DATABASE

OCCURRENCE OF INJURIES

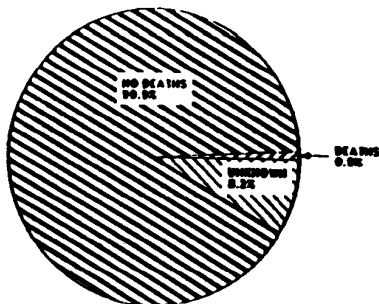
ALL EVENTS



NUMBER OF EVENTS = 6928

OCCURRENCE OF DEATHS

ALL EVENTS



NUMBER OF EVENTS = 6928

EXHIBIT C
ACUTE HAZARDOUS EVENTS DATABASE
DISTRIBUTION OF EVENTS BY CHEMICAL FOR DEATH/INJURY EVENTS

Contribution of the 10 Most Frequently-Occurring Chemicals to the Events with Deaths or Injuries

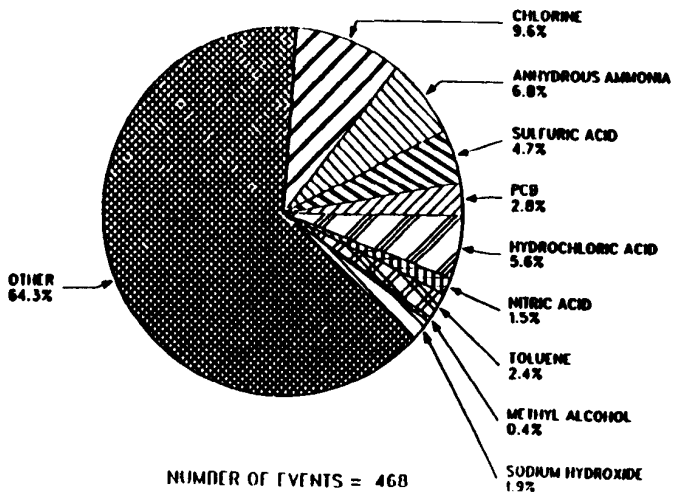
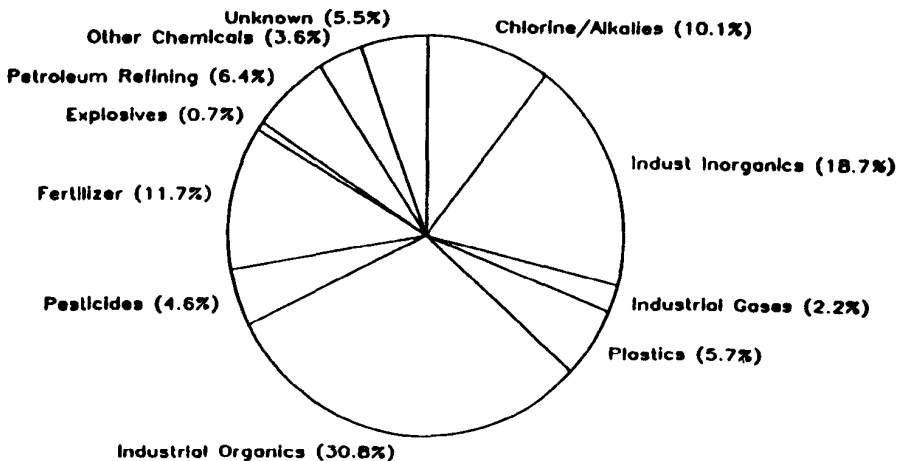


EXHIBIT D

DISTRIBUTION OF EVENTS WITH INJURIES

Contribution of Chemical Categories



NUMBER OF EVENTS = 468

EXHIBIT E

ACUTE HAZARDOUS EVENTS DATABASE FREQUENCY DISTRIBUTION BY RELEASE SIZE FOR EVENTS INVOLVING DEATHS AND INJURIES

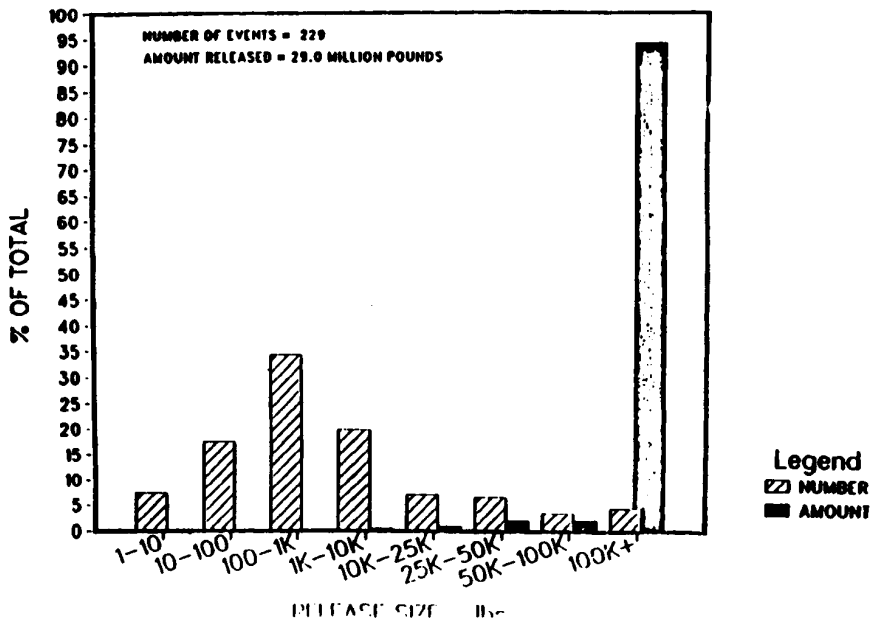


EXHIBIT F
ACUTE HAZARDOUS EVENTS DATABASE
NUMBER OF EVENTS BY REPORTABLE QUANTITY
FOR DEATH AND INJURY EVENTS

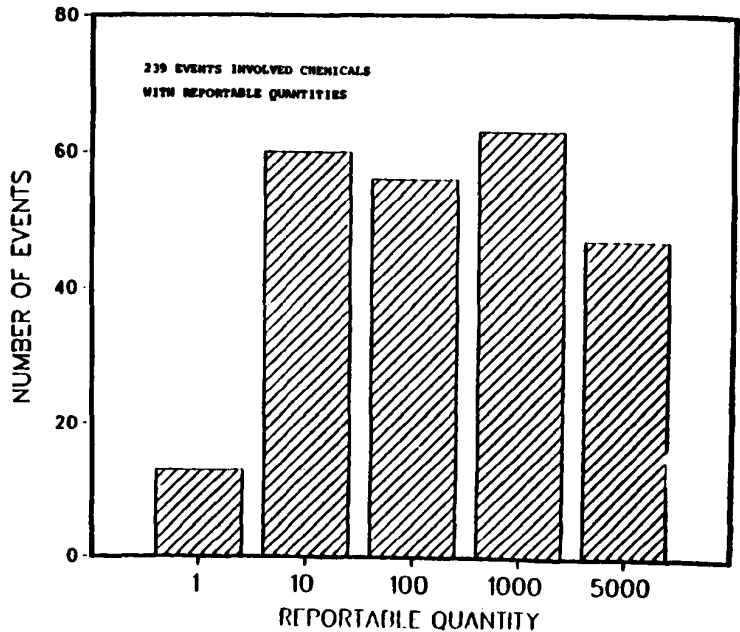
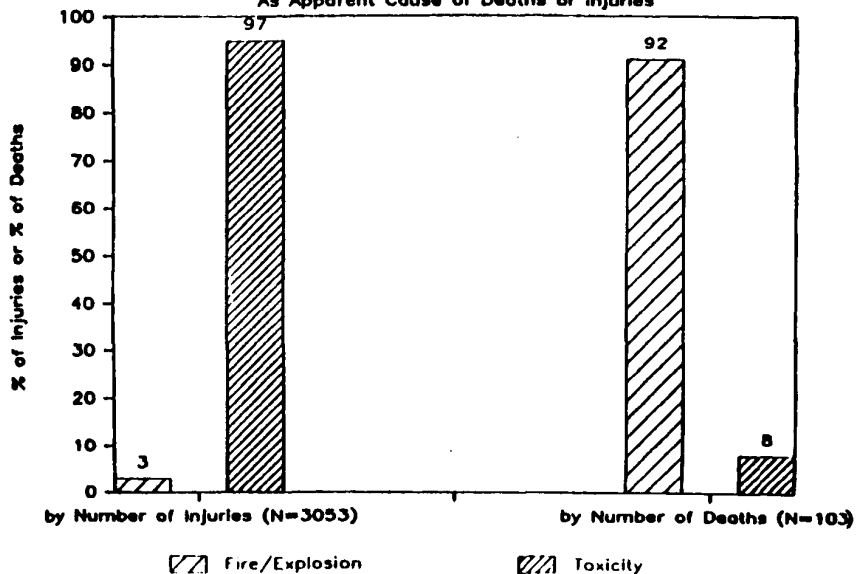


EXHIBIT G

ROLE of FIRE/EXPLOSION vs TOXICITY

As Apparent Cause of Deaths or Injuries



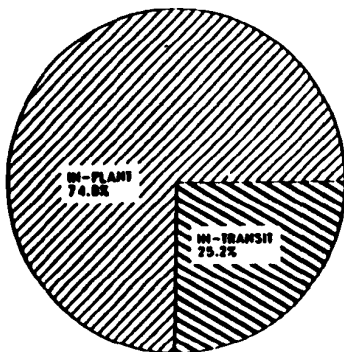
MONS 026453

EXHIBIT H

ACUTE HAZARDOUS EVENTS DATABASE

IN-PLANT VS. IN-TRANSIT EVENTS

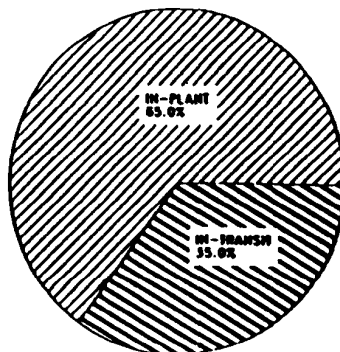
ALL EVENTS



NUMBER OF EVENTS = 6928

IN-PLANT VS. IN-TRANSIT EVENTS

DEATH/INJURY EVENTS

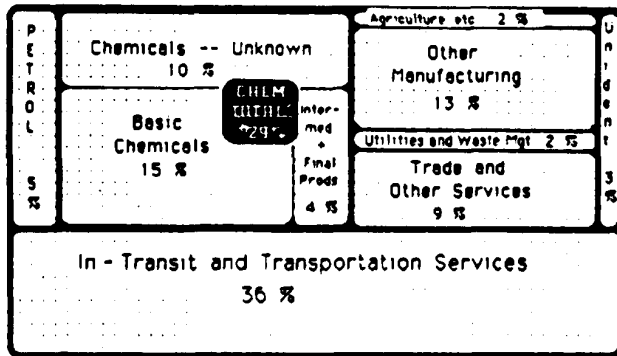


NUMBER OF EVENTS = 468

MONS 026454

EXHIBIT I

Reported Number of Injuries Distribution by Industry Sector



TOTAL INJURIES 4717 in five year period

EXHIBIT J

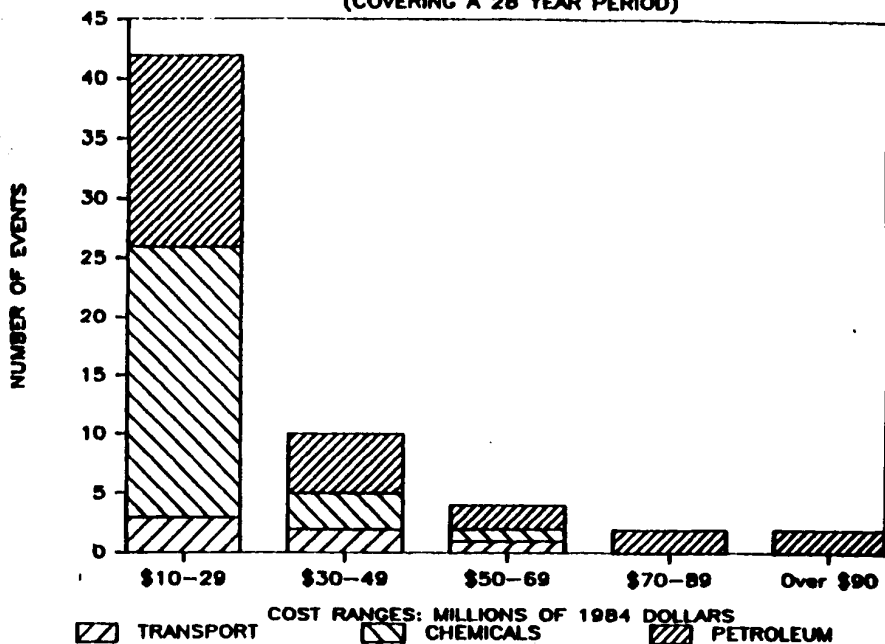
Reported Number of Deaths

Distribution by Industry Sector

Petroleum Refining	13 %	Chemicals -- Unknown	9 %	Other Manufacture	7 %
BASIC CHEMICALS	CHEMICAL TOTAL 78 %	Chemical Intermediates and Finished Products	25 %	Utilities and Waste Mgt	5 %
				Wholesale and Retail Trade and Other Services	12 %
				In-Transit and Transportation Services	24 %

TOTAL DEATHS 138 in five year period

EXHIBIT K
EVENTS WITH HIGHEST DAMAGE COSTS
(COVERING A 28 YEAR PERIOD)



MONS 026457

EXHIBIT L
ACUTE HAZARDOUS EVENTS DATABASE
FREQUENCY DISTRIBUTION BY RELEASE SIZE
FOR ALL EVENTS

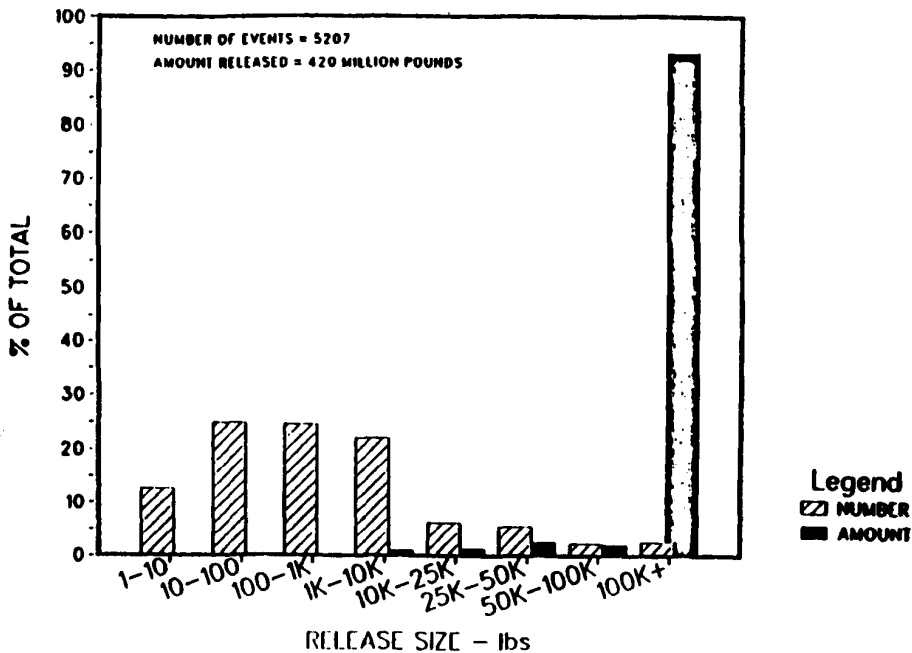
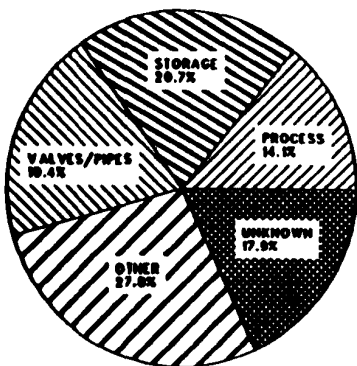


EXHIBIT M

ACUTE HAZARDOUS EVENTS DATABASE

IN-PLANT EVENTS BY LOCATION

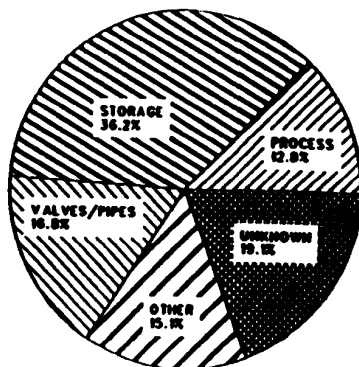
ALL EVENTS



NUMBER OF EVENTS = 5179

IN-PLANT EVENTS BY LOCATION

DEATH/INJURY EVENTS



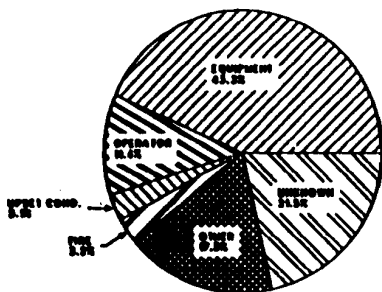
NUMBER OF EVENTS = 304

EXHIBIT N

ACUTE HAZARDOUS EVENTS DATABASE

IN-PLANT EVENTS BY CAUSE

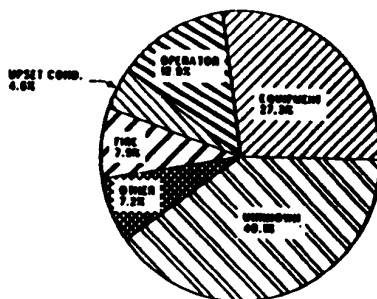
ALL EVENTS



NUMBER OF EVENTS = 5179

IN-PLANT EVENTS BY CAUSE

DEATH/INJURY EVENTS

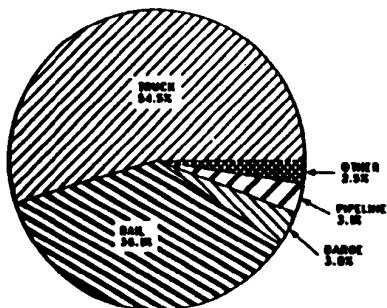


NUMBER OF EVENTS = 304

EXHIBIT O
ACUTE HAZARDOUS EVENTS DATABASE

IN-TRANSIT EVENTS BY MODE

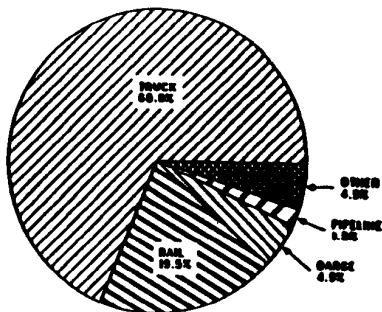
ALL EVENTS



NUMBER OF EVENTS = 1749

IN-TRANSIT EVENTS BY MODE

DEATH/INJURY EVENTS



NUMBER OF EVENTS = 164

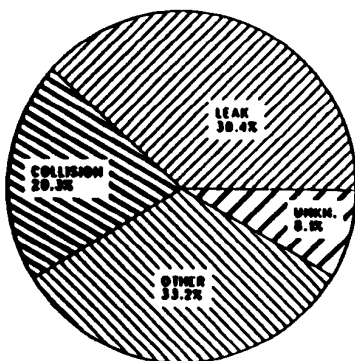
MONS 026461

EXHIBIT P

ACUTE HAZARDOUS EVENTS DATABASE

IN-TRANSIT EVENTS BY CAUSE

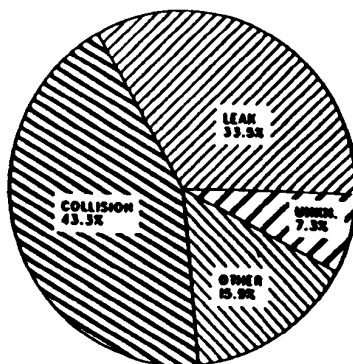
ALL EVENTS



NUMBER OF EVENTS = 1749

IN-TRANSIT EVENTS BY CAUSE

DEATH/INJURY EVENTS



NUMBER OF EVENTS = 164