2000 Oklahoma TRI
Toxics Release Inventory

Summary Report

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Executive Summary

Environmental releases of toxic wastes continue to decrease in Oklahoma according to numbers based on Toxics Release Inventory (TRI) figures for the year 2000, the most current reporting year. This is the fourteenth year the DEQ has compiled this information. Information in this report reflects legal emissions, transfers, and treatment of over 600 toxic chemicals used by 323 Oklahoma facilities required by federal law to report. Permits issued by state and federal agencies regulate the releases and transfers of chemicals used in the manufacturing of a wide variety of products. Reporting industries must have at least 10 full time employees and be of specific types including manufacturing, coal-fired electric power generation, commercial hazardous waste disposal, bulk petroleum terminals, and solvent recovery. The U.S. Environmental Protection Agency (EPA) collects the TRI information on a national basis. This is the third annual TRI summary report published.

Releases include those chemicals emitted directly into air, water or onto land. Transfers include chemicals going into public sewers, off-site landfills or other disposal facilities. Re-use figures include figures for chemicals recycled or used for energy recovery. Treatment numbers include both on-site and off-site treatment that destroys the toxic chemical. When summed, the figures reflect total production-related wastes generated. Oklahoma companies reported 28.8 million pounds released in 2000, a decrease of 4 million pounds, a 12 percent decline from last year. This is a reduction of close to 10 million pounds when compared to 1998 figures. Substantial decreases in emissions to land and surface waters accounted for the majority of the reduction in releases. Re-use, primarily recycling, decreased 7 million pounds from last year's report to a total of 62.5 million pounds. In addition, 47.9 million pounds of chemicals were destroyed by treatment and 3.4 million pounds of chemicals were transferred off-site for proper disposal. The total of all these activities reflects the total production related waste generated by the facilities required to report in Oklahoma. For 2000 the total was 142.6 million pounds, a slight decline from 1999. Even with recent changes that increased the number of reporting industries and reinterpretation of the basis for calculating common chemical releases, total production related waste for 2000 was 1.4 million pounds lower than reported in 1997, the year before reporting changes began. Analysis provided in this report indicates that production related waste in Oklahoma is decreasing over time due in part to the continued effectiveness of voluntary pollution prevention programs sponsored by DEQ and the cooperation of industries throughout the State.

In 2000, thresholds for chemicals classified as Persistent, Bioaccumulative and Toxic chemicals (PBT's) were substantially lowered with the addition of some chemicals previously not listed for TRI reporting. These chemicals, many with a potential to seriously impact the environment, are tracked at lower levels under the new requirements. The number of reports processed by the DEQ increased by about 20 percent due to the implementation of the PBT rule.

For many years DEQ also has maintained a database for the Hazardous Chemical Inventory, better known as Tier II reporting. For 2000, over 28,000 Tier II reports were received and processed by the agency. The information provided on Tier II reports describes the quantity, container type and locations of stored hazardous chemicals or materials. Covered facilities and sites submit forms annually to Local Emergency Planning Committees and local fire departments as well as to DEQ. Tier II reports are often the first data used by emergency responders and other local entities to prepare for chemical incidents. This is the first year Tier II data has been presented in a published report.

Glossary

Acid aerosols- Mists, vapors, gas, fog and other airborne forms of any particle size of a chemical; current TRI usage refers to aerosols of sulfuric acid or hydrochloric acid.

Bioaccumulation- The process by which organisms may accumulate chemical substances in their bodies. The term refers to both uptake of chemicals from water and from ingested food and sediment residues.

*De minimus***-** An exemption to TRI reporting whereby any chemical or chemical group that comprises less than 1 percent of a mixture need not be reported even if the total quantity of the chemical exceeds the threshold quantity. If Occupational Safety and Health Administration (OSHA) lists the chemical or chemical group as a carcinogen, the *de minimus* concentration drops to 0.1 percent.

DEQ- Oklahoma Department of Environmental Quality

EPCRA- Emergency Planning and Community Right to Know (see **SARA Title III**)

Energy Recovery- Recovery of useful energy from waste mainly through combustion of chemical waste.

Facility- Defined for the purposes of TRI reporting as all buildings, equipment, structures and other stationary items which are located on a single site or on contiguous or adjacent sites and which are owned or operated by the same entity.

Fugitive (Non-Point) Air Releases- Emissions to the air that are not conveyed through stacks, vents, ducts, pipes or other confined air streams. Examples include equipment leaks from valves, pump seals, flanges, compressors, sampling connections, open-ended lines and evaporative losses from surface impoundments and spills.

Manufacture- To produce, prepare, import or compound a toxic chemical.

Off-Site Locations- Locations outside the boundaries of a facility to which wastes are transported for treatment, energy recovery, recycling or disposal.

Otherwise Use- Any use of a toxic chemical at a facility which is not covered by the definition of manufacture or process. This includes any activities in which a listed toxic chemical does not become intentionally incorporated into the final product for distribution in commerce. Examples of otherwise use include but are not limited to degreasers, solvents in paints that are applied to a product, chemicals used in water treatment and refrigerants or coolants.

Persistence- As related to chemicals in the environment, the length of time a chemical can exist in the environment before being destroyed (i.e., transformed) by natural processes.

Publicly Owned Treatment Works (POTW)- A wastewater treatment facility that is owned by a unit of the government.

Process- Refers to the preparation of a listed toxic chemical after its manufacture for distribution in commerce. Processing is usually the intentional incorporation of a toxic chemical into a product. It includes but is not limited to making mixtures, repackaging or using a toxic chemical as a feedstock, raw material or starting material for making another chemical.

RCRA- Resource Conservation and Recovery Act

Recycle- The process of capturing a useful product from a waste stream. Solvent recovery, metals recovery and acid regeneration are examples of recycling.

Glossary

Releases- Refers to on-site discharges of TRI listed chemicals to the air, water, land or disposal in underground injection wells. Includes permitted, accidental and non-permitted discharges.

Releases to Air- Sum of Fugitive (Non-Point) Air Releases plus Stack (Point Source) Air Releases.

Releases to Land- Refers to land filling, surface impoundments, land treatment/application farming or any other release of a toxic chemical to land within the boundaries of a facility.

Releases to Water- Refers to discharging of chemicals to surface waters such as rivers, lakes, ponds and streams.

SARA Title III- The section of the Superfund Amendments and Reauthorization Act (SARA) which mandates Emergency Planning and Community Right to Know.

Stack (Point Source) Air Releases- Emissions to the air that are conveyed through stacks, vents, ducts, pipes or other confined air streams. Examples include storage tank emissions from air pollution control equipment.

Standard Industrial Classification Code (SIC Code)- A four digit number code designated by the Federal Office of Management and Budget to describe the type of activity(s) at a facility. The first two numbers of the code define a major business sector and the last two numbers define a facility's specialty within the major sector.

Toxic- A substance that produces or causes a systemic damage to an organism.

TRI- Toxics Release Inventory; Section 313 of SARA Title III

Transfers- Refers to TRI listed chemicals sent off-site for energy recovery, recycling, treatment or disposal. Reported as transfers to either Publicly Owned Treatment Works or other off-site transfers (non-POTW) such as incinerators, landfills, other treatment, recycling, energy recovery or disposal facilities not part of the reporting facility.

Background

In 1984, a release of deadly methyl isocyanate gas in Bhopal, India resulted in the deaths of thousands. Soon after, a serious, although not fatal, chemical release occurred at a similar plant in West Virginia. These incidents emphasized the need for communities to be informed of hazardous materials in their midst and to plan for chemical emergencies. In response, the United States Congress passed Title III of the Superfund Amendments and Reauthorization Act (SARA), also known as Emergency Planning and Community Right-to-Know Act (EPCRA) on October 16, 1986. The fundamental purposes of the Act are to provide the public with information about toxic chemicals used and stored within communities thereby raising public awareness of potential chemical hazards, and to encourage local planning for chemical emergencies. Section 313 of this Bill, known as the Toxics Release Inventory (TRI), requires covered industries that manufacture, process or otherwise use any of over 600 listed toxic chemicals to report releases and waste management of these chemicals to the federal Environmental Protection Agency (EPA) and to states annually. Under Section 312, the Emergency and Hazardous Chemical Inventory (Tier II), sites storing certain quantities or greater of any hazardous chemical or material also must report the storage of these once a year. By mandate, information contained in the TRI and Tier IIs are available to the public.

Facilities covered by TRI report total quantities of wastes generated, as well as the maximum amounts of listed toxic chemicals present on-site during the calendar year. Releases of chemical wastes are reported according to the media into which they are released: air, water, land or underground injection. Additionally, figures for off-site transfers of waste chemicals to separate facilities for treatment, disposal, or reuse are reported. The Pollution Prevention Act of 1990 required additional information regarding reductions in the use of toxic chemicals and in waste streams to be reported in the TRI. These changes underscore the importance of pollution prevention and encourage the development and implementation of measures for reducing wastes. Since 1991, TRI has contained information on the re-use of chemicals, including the quantities of chemicals recycled or combusted for energy recovery as well as methods used for reducing the need for toxic chemicals. Treatment numbers reported include both on-site and off-site treatments to neutralize or reduce the effects of the toxic chemical. The total of release, transfer, and re-use numbers yields a value for the total production-related wastes generated annually.

Tier II reports describe chemical storage and include information on the type and location of storage containers, maximum and average quantities stored and health and physical hazards. Additionally, Tier II data list the number of facilities storing extremely hazardous substances (EHS). Reports are filed with the states, the appropriate Local Emergency Planning Committee (LEPC) and the local fire department.

The Oklahoma Department of Environmental Quality receives TRI report forms annually from Oklahoma industries covered under Section 313, compiles and maintains a TRI database, reconciles it to the EPA database and analyzes the data. In 2001, DEQ received and processed 1,199 reports for the 2000-reporting year. Because the intent of the Toxics Release Inventory is to provide information for the public, it frequently is the first set of data supplied to and examined by citizens or citizen workgroups in the resolution of complaints against a specific facility. Schools, hospitals and others often use the information in determining site selections. TRI data is used as an indicator of the progress facilities or industries achieve in waste reduction and the dissemination of TRI data can encourage dialogue between citizens and industries. Trends in TRI data frequently serve as markers for the progress environmental programs.

Similarly, the agency receives Tier II reports from throughout the State and constructs a database yearly. EPA does not receive Tier II forms and therefore does not maintain or analyze a database.

Background

For RY 2000, DEQ received 28,889 Tier II forms, 1,267 of those describing storage of a chemical designated as an Extremely Hazardous Substance (EHS). Where TRI data describe use, releases, waste management and pollution prevention activities and are generally used for long-term assessments or plans, Tier II reports storage of chemical hazards and is the most frequently used source of information for emergency planning. First responders often rely on information submitted on Tier IIs when responding to incidents at or near reporting sites.

The information generated by these programs is available from DEQ to emergency managers, fire departments, Local Emergency Planning Committees, emergency medical services, law enforcement and the general public. Local entities can use the data to identify potential chemical hazards and prepare for chemical emergencies, which allows faster and more efficient responses. Additional copies of this report or more in depth information about TRI or Tier II reporting or other EPCRA programs may be obtained by contacting the Oklahoma DEQ Customer Services Division/ SARA Title III Programs at 405-702-1000 or at 1-800-869-1400 or by visiting the DEQ website at:

http://www.deq.state.ok.us/CSDnew/saraiii.htm

Limitations of TRI Data

TRI reports information on the quantities of specified toxic chemicals released and managed by facilities covered under Section 313 of SARA Title III. As such, TRI is the most comprehensive overview available of chemical usage, releases and waste management techniques. Responsible use of this information can enable the public to identify and better understand potential hazards in the community. From there, communities can delineate plans of action in the event of chemical emergencies and work with industry and government to reduce toxic releases. However, there are limitations to consider when using TRI data.

Releases reported in the TRI are regulated under permits issued by State and Federal agencies. Transfers to off-site locations for treatment, storage or disposal also are regulated, as are on-site disposals. For example, sites permitted under RCRA Subtitle C are strictly regulated and monitored to insure that human exposure and impact to the environment are minimal. It should not be construed that all TRI releases have direct deleterious effects. Prior to 1998, only manufacturing facilities were required to report to the TRI. The addition of seven industrial categories expanded TRI reporting; however, not all sources of toxic materials are covered. For example, neither transportation emissions nor releases from small facilities are reported.

TRI expanded for reporting year 1995 to double the number of covered chemicals or chemical groups. At present, over 600 chemicals and chemical groups known to impact human health, the environment, or both are reported. As extensive as the current list is, it does not include every toxic chemical used in industry. Chemicals that are reportable under TRI vary greatly in individual toxicity and persistence in the environment. For example, the release of a small quantity of a highly toxic material, whose usage may fall below the reporting threshold could pose a more serious health or environmental hazard than a large release of a less toxic chemical. The rule for Persistent, Bioaccumulative and Toxic chemicals (PBT) is an initial step in addressing these variabilities (see "Chemicals Reported in 2000") TRI is based on the quantities of chemicals used and facility classifications, not on the quantities of chemicals released. The different media into which toxic chemicals are released greatly affects exposure levels and the means of exposure (inhalation, dermal absorption or ingestion). For example, disposals to underground injection wells are reported as a releases even though the potential impact on public health or environmental is minimal. Quantities in the TRI database are totals for a given year; peak concentrations or accidental discharges are not specifically cited. Therefore, health assessments or environmental risks/ exposures based solely on TRI data are not valid.

Facilities are required to base TRI reports on monitoring data when available. However, if actual process data are not available, TRI figures can be based on estimates. In fact, much of the data generated is estimated. Although EPA publishes estimation guidance, several techniques can be used. Variations between similar facilities may result from the use of different estimation methodologies or differences in technologies. The production level of a facility may change from year to year and consequently affect the quantities of chemicals released. Productivity ratios are provided by facilities for each chemical released and can be used to compare quantities released from year to year, however, this assumes a direct linear relationship between production levels and wastes generated which is not always accurate. For example, total wastes may fall as productivity improves due to waste reduction or improved process efficiency. Also productivity ratios will not take into account chemical releases resulting from any remedial action or one-time event. These factors should be considered when reviewing TRI data.

Limitations of TRI Data

Continued changes in TRI reporting, such as the increase in the number of chemicals covered and the addition of industrial categories, reflect efforts to build the TRI into an increasingly comprehensive database. Expansions of the program, however, necessitate that the data be viewed with caution when making comparisons from year to year. Many of the chemical releases reported in the TRI are permitted under State programs and data from these regulatory programs should provide additional information to inform citizens about toxic chemicals in the environment.

2000 TRI Overview

Forty-eight of seventy-seven Oklahoma counties contain industrial facilities that meet threshold requirements for TRI reporting and a total of 323 facilities reported for 2000 (Figure 1). In nine counties, the total of releases from all TRI facilities exceeded one million pounds. These counties include the major metropolitan areas of Oklahoma City and Tulsa, counties accessing the Port of Catoosa and counties with major wood processing/paper manufacturing facilities or major treatment, storage and disposal sites. Further information on releases in individual counties can be found in Table A.

Oklahoma continues to see a real decline in the quantities of toxic chemical wastes generated, especially when the addition of new industrial categories and the reassessment of nitrate reporting are considered. Total production related wastes were 142.6 million pounds in 2000 compared to 144 million pounds in 1997 before these changes were in effect (Figure 2).

For 2000 Oklahoma companies reported:

- 28.8 million pounds released
- 3.4 million pounds transferred for disposal
- 62.5 million pounds reused
- 47.9 million pounds treated

Total releases were:

- 18.7 million pounds released to air
- 5.1 million pounds released to land or permitted landfills
- 2.5 million pounds disposed of in underground injection wells
- 2.5 million pounds discharged to surface waters. (Figures 3 & 4)

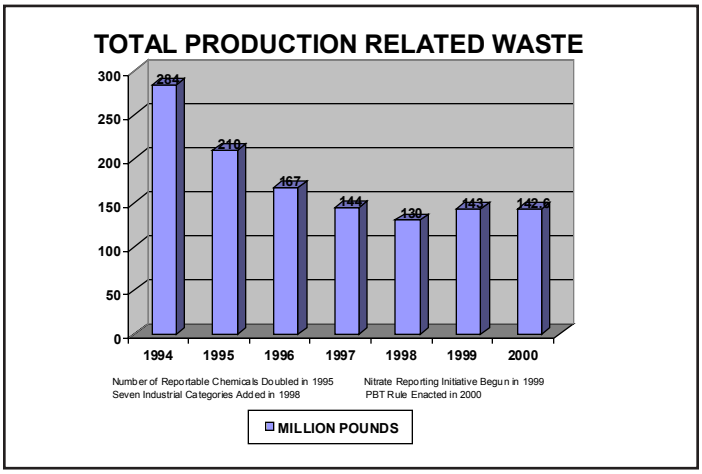

Figure 2

Releases

Total **air releases** are the sum of permitted stack releases and fugitive air releases that result largely from the natural volatility of some chemical compounds. The increase in total air releases for 1998 compared to 1997 was due to the first time reporting by industries added for 1998, especially coal-fired electrical plants. Therefore, the figures reflected an increase in the number of facilities reporting rather than an increase in actual air emissions in the State. These facilities, some that utilize coal for start-ups only, account for the majority of electrical utilities in the State. Yet even with the significant increase in the number and size of facilities reporting in 1998, total air releases decreased 4.7 million pounds from 1998 to 2000 (Figure 5). This demonstrates that the goal of cleaner air in the State is being attained, and is an indication of the continued success between DEQ sponsored pollution prevention programs and the industries that participate in them.

Total **on-site releases to land** include surface impoundments, land application, use of permitted landfills or other release to land within the boundaries of a facility. These increased significantly in 1998 when

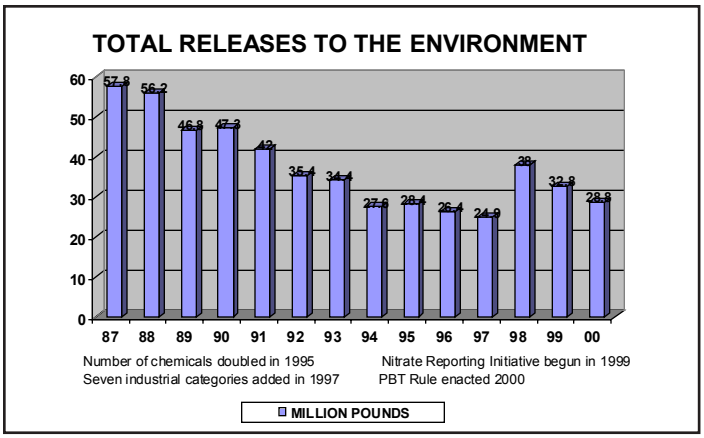

Figure 3

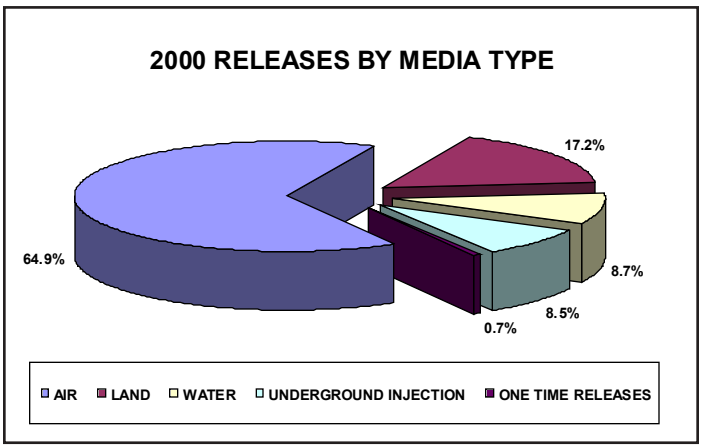

Figure 4

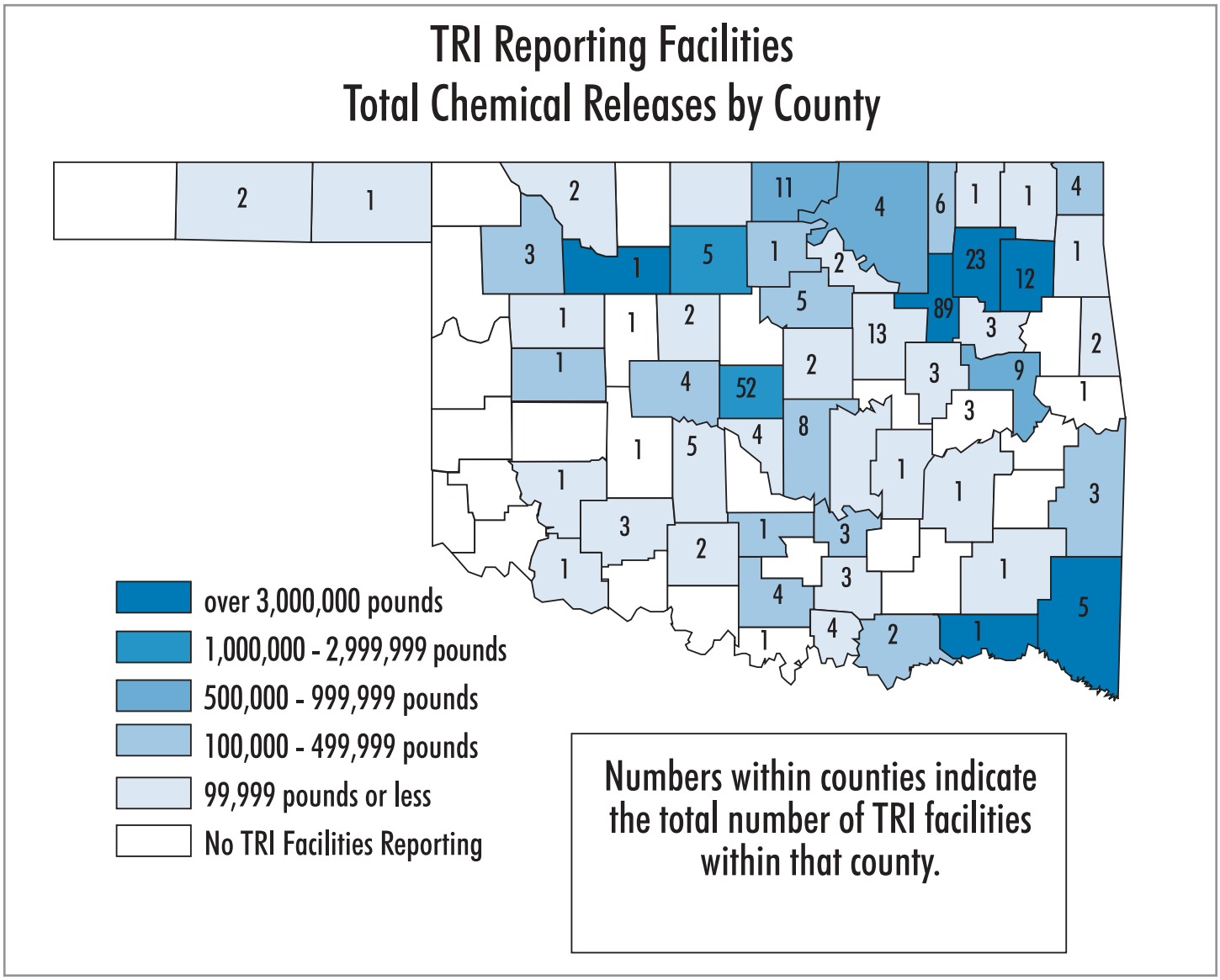

Figure 1

industrial waste handlers permitted under RCRA Subtitle C were covered under TRI for the first time. Additionally, a frequent medium for disposal of nitrate compounds is release to surface impoundments or total retention lagoons and the nitrate reporting initiative in 1999 caused the figure for total on-site releases to land to increase again. Oklahoma treatment, storage and disposal facilities receive transfers from both in-state and out-of-state companies for managed disposal of toxic wastes. However, for 2000 one such facility, Safety Kleen-Lone Mountain, reported a 3.7 million pound decrease in land releases from 1999, a quantity that accounts for the majority of the 3.9 million pounds decline from 1999 to 2000 (Figure 6).

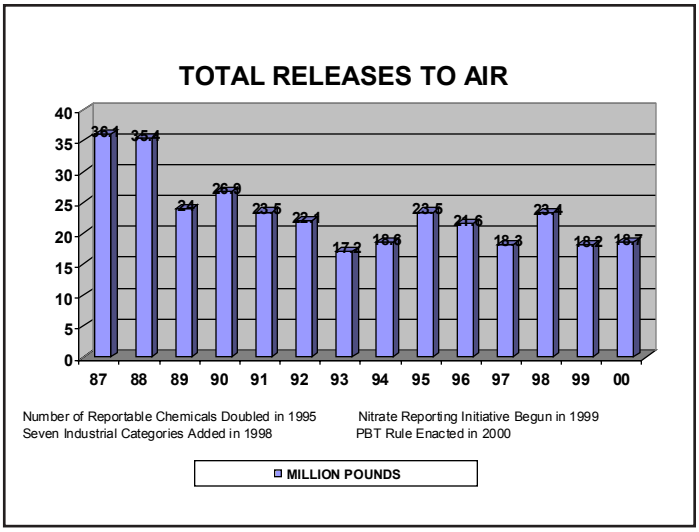

Figure 5

2000 TRI Overview

Release to permitted **underground injection wells** is another medium for waste management that continues to decline (Figure 7). While disposals to deep underground injection wells are considered releases under TRI, this type of waste management has an extremely low potential for human exposure or contact with the environment.

Following a dramatic increase in 1999, total **releases to surface waters** fell back by 20 percent in 2000 (Figure 8). EPA's reinterpretation of reporting water dissociable nitrates, the Nitrate Initiative, addressed under reporting or non-reporting of aqueous nitrate compounds. The consequent jump in surface water releases actually represented an improvement in reporting accuracy rather than an actual increase in releases. In 2000, a number of those companies whose reporting was severely impacted by the Nitrate Initiative implemented measures to reduce the quantities of nitrate compounds in their discharges. These efforts largely produced the decrease in 2000. Additionally, the number of facilities reporting releases to rivers or streams decreased slightly from 1999 to 2000.

Transfers

Transfers to off-site facilities for disposal increased slightly in 2000. However, the current figures are only 26 percent of those reported a decade ago as the trend toward waste reduction continues even as the TRI program expands (Figure 9). Releases to Publicly Owned Treatment Works (POTW) consist of water discharges made into sanitary drains and sewers that then are received and treated by waste water treatment plants and are counted as transfers for treatment rather than releases. Discharges of metals and metal compounds are the exception and are counted as releases. Municipalities generally require acid neutralization as pretreatment prior to discharge into a sanitary sewer and nitrate compounds formed by the neutralization of nitric acid were a particular focus of the Nitrate Initiative. Accordingly quantities reported for transfers to POTWs rose in the previous year. However, in 2000 transfers to POTWs declined by 266,000 pounds from the 1999 increase (Figure 10). Presently only 24 percent of wastes containing toxic chemicals per TRI are transported off-site for disposal or reuse (Figure 11).

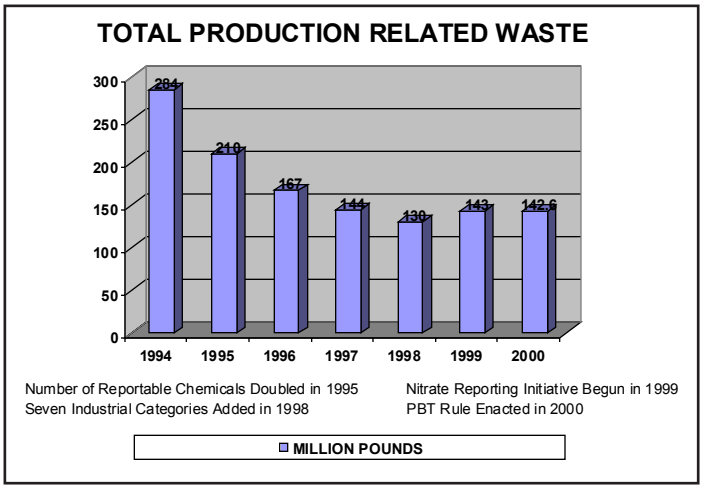

Figure 6

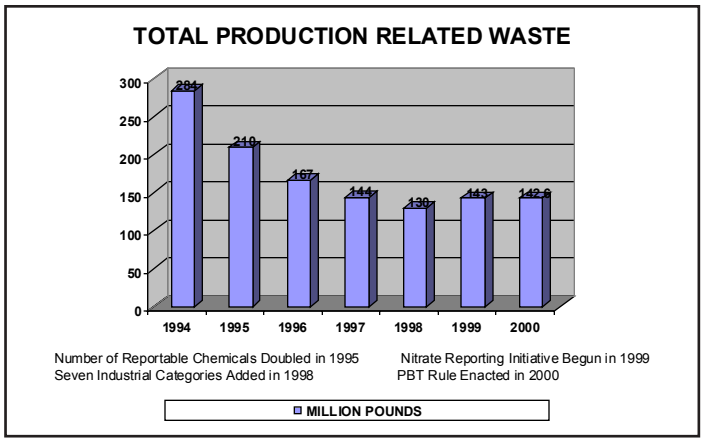

Figure 7

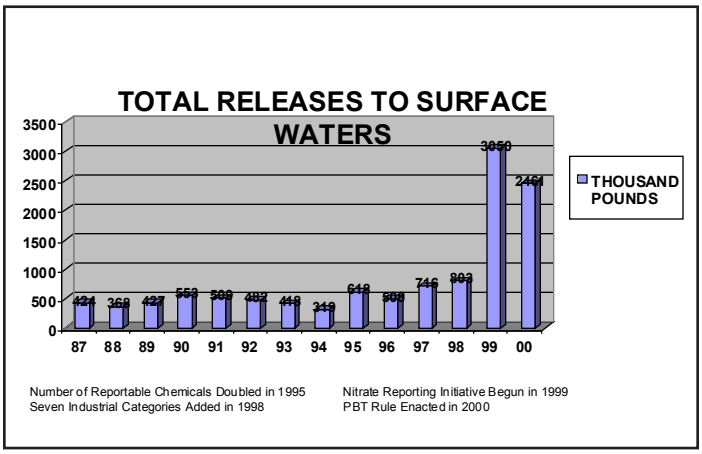

Figure 8

COUNTY	AIR	LAND	INJECTION	WATER	TOT. ON-SITE REL'S.	OFF-SITE TRANS.	POTW TRANS.	TOT. TRANS.	TOT. RECYCLING	TOT. ENERGY REC.	TOT. TREATMENT
Adair	48,090	-	-	-	48,090	30,351	5	170		17,484	
Alfalfa	-	-	-	-	-	-	-				
Atoka	-	-	-	-	-	-	-				
Beaver	15,968	-	-	-	15,968	-	-				19,533
Beckham	-	-	-	-	-	-	-				
Blaine	2	-	-	-	2	-	-				
Bryan	139,329	770	-	-	140,099	56,510	-	11,009		2,310	
Caddo	-	-	-	-	-	-	-				
Canadian	90,162	-	-	-	90,162	984,389	249,032	2,496	1,306,645	107,426	443,971
Carter	318,869	-	-	247,632	566,501	290,175	11,377	145,261	483,773	227,031	5,199,766
Cherokee	-	-	-	-	-	-	20,686				
Choctaw	231,509	7,304	-	-	238,813	-	-	2,927,736	2,291,730		
Cimarron	-	-	-	-	-	-	-				
Cleveland	1,157	-	-	5	1,162	241,106	5	6,138	216,906		
Coal	-	-	-	-	-	-	-				
Comanche	1,330	60,603	-	124	62,057	217,938	6,281	57,020	206,501	1,541	38,903
Cotton	-	-	-	-	-	-	-				
Craig	-	-	-	-	-	5,147,920	-		5,147,420	195	58
Creek	9,330	3,764	-	-	13,094	823,835	36,500	441,245	390,159	46	128,948
Custer	145,019	-	-	-	145,019	329,609	-		150	66,600	1,193,558
Delaware	-	-	-	-	-	-	500				18,060
Dewey	-	-	-	-	-	-	-				
Ellis	-	-	-	-	-	-	-				
Garfield	2,396,745	500	-	21,510	2,418,755	4	-		2,483,800		1,713,600
Garvin	111,698	1,250	-	18,030	130,978	125	-			230,117	142,100
Grady	57,086	-	-	-	57,086	156,883	57,153	141,084	105,193		101,000
Grant	-	-	-	-	-	-	-				
Greer	-	-	-	-	-	-	-				
Harmon	-	-	-	-	-	-	-				
Harper	-	-	-	-	-	-	-				
Haskell	-	-	-	-	-	-	-				
Hughes	-	-	-	-	-	-	-				
Jackson	-	-	-	-	-	-	-				
Jefferson	-	-	-	-	-	-	-				
Johnston	13,180	-	-	-	13,180	551	-	551		551	
Kay	597,596	4,635	-	79,347	681,578	376,763	1,054	20	365,916	2,638	2,019,520
Kingfisher	15,415	-	-	-	15,415	-	-		1,234,100		
Kiowa	343	-	-	-	-	-	-				
Latimer	-	-	-	-	-	-	-				
LeFlore	133,644	-	-	-	133,644	596,606	7,602	643,581			7,602
Lincoln	3,250	-	-	-	3,250	3,900	-		3,900		3,250

Logan	-	-	-	-	-	-	-				
Love	42,929	-	-	-	-	-	-				
Major	576	2,538,112	-	-	2,538,688	62,712	-	3,672			349,675
Marshall	186,113	15	-	-	186,128	41,213	-	14,400	10,640	25,260	
Mayes	345,605	1,497,561	69,730	1,809,186	3,722,082	287,834	-		287,838		21,904,718
McClain	-	-	-	-	-	-	-				
McCurtain	3,316,779	29,399	-	44,550	3,390,728	1,250	3,500	250	2,250		5,092,620
McIntosh	48,137	-	-	10	48,147	14,664	-		14,310		26,014
Murray	-	-	-	-	-	-	-				
Muskogee	910,618	135,869	-	30,469	1,076,956	252,348	5	762,902		27,624	694,578
Noble	254,940	35,560	-	448	290,948	25	-	166,547			310,000
Nowata	147	-	-	-	-	-	-				
Ofuskee	-	-	-	-	-	-	-				
Oklahoma	2,196,305	7,392	-	260	2,203,957	1,020,686	127,724	2,740	913,631	146,848	694,842
Okmulgee	39,825	-	-	-	39,825	17,153	26,045			17,153	26,045
Osage	1,008,855	-	800	-	1,009,655	320,979	20		34,148,685	281,901	98,586
Ottawa	205,869	-	-	-	205,869	6,700	-	12,806	4,900		69,610
Pawnee	5,962	53,337	-	539	-	30,794	-		1,719	5,887	
Payne	172,618	-	-	205	172,823	491,320	27	199,588	332,403	22,750	28,824
Pittsburg	5,846	80,833	-	-	86,679	-	-		374,181		578,152
Pontotoc	39,500	-	-	-	39,500	734,102	-		625,915	108,100	463,045
Pottawatomie	89,587	598	-	272	90,457	236,930	14,581	83,822	451,154	107	41,000
Pushmataha	-	-	-	-	0	15,832	-	1,196			2,873
Roger Mills	-	-	-	-	-	-	-				
Rogers	3,463,220	401,744	-	217,757	4,082,721	4,027,779	572	203,467	7,499,347	15,003	287,523
Seminole	-	-	-	-	0	-	-		97,900		
Sequoyah	6,071	10	-	-	-	-	-				
Stephens	1,384	-	-	-	1,384	60,971	-		146,778	14,193	
Texas	30,000	-	-	-	30,000	-	100,000	10			
Tillman	33,000	-	-	15	33,015	10,845	-	20,158	10,785		10,785
Tulsa	900,976	31,947	2,388,544	6,284	3,327,751	6,498,657	82,219	460,117	6,427,046	2,402,712	6,117,159
Wagoner	1,950	-	-	5	1,955	40,918	250	120,442	3,494		14,718
Washington	939	50,787	1,953	14	53,693	1,318,246	11	357,673	566,296	107	14
Washita	-	-	-	-	-	-	-				
Woods	80,000	-	-	-	80,000	-	-				
Woodward	655,397	8,992	-	42,050	706,439	2,698	-		1,371		2,508

Reuse

Total production related wastes and total releases continue to diminish through source reductions and increased reuse programs. Although total reuse dropped slightly (Figure 12), on- and off-site recycling continues to increase (Figure 13). In 2000, 53.5 percent of all chemicals reportable under TRI were managed by recycling, increasing from 49 percent in 1999. The DEQ Pollution Prevention Program established and maintains a waste exchange list that promotes the use, reuse or recycling of industrial waste streams. Industrial waste handlers maintain these lists as well. This type of recycling not only reduces the quantities of toxic chemicals that ultimately find their way into the environment, but also in many instances, reduces the need to manufacture some of these chemicals, thus eliminating other potential wastes.

On-site recycling and on-site treatment minimize the need to transport toxics for disposal or off-site reuse. This decreases exposure risks due to transportation related incidents and demonstrates Oklahoma industries are managing the majority of wastes on-site (Figure 14). On-site waste management along with voluntary reductions in the quantity and toxicity of chemicals used are

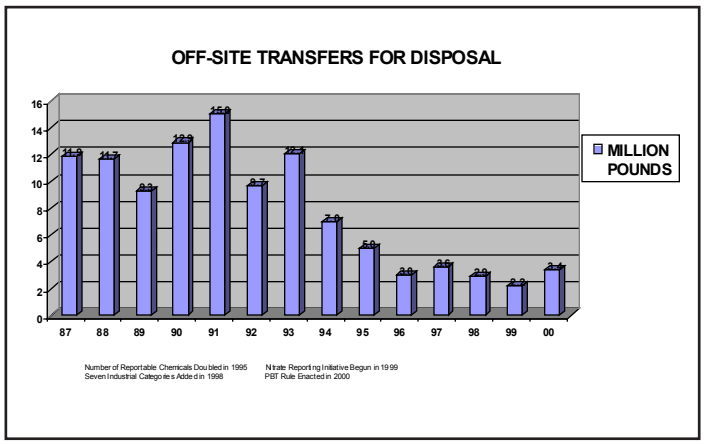

Figure 9

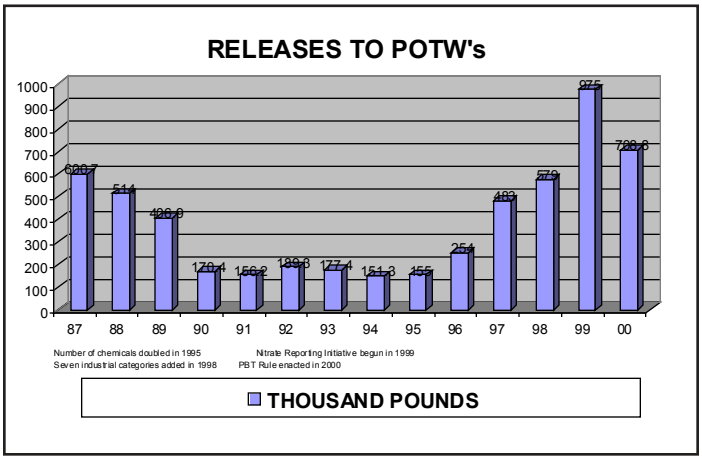

Figure 10

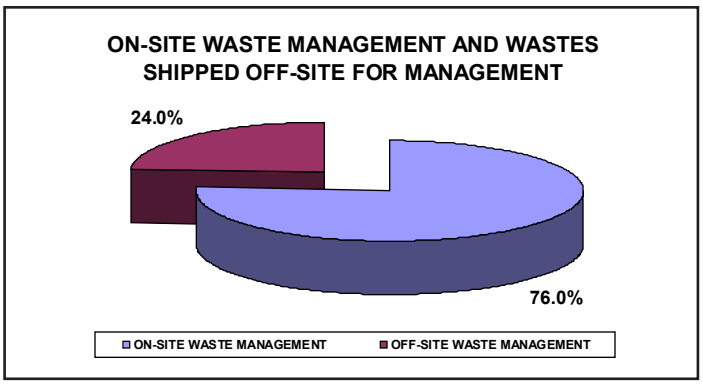

Figure 11

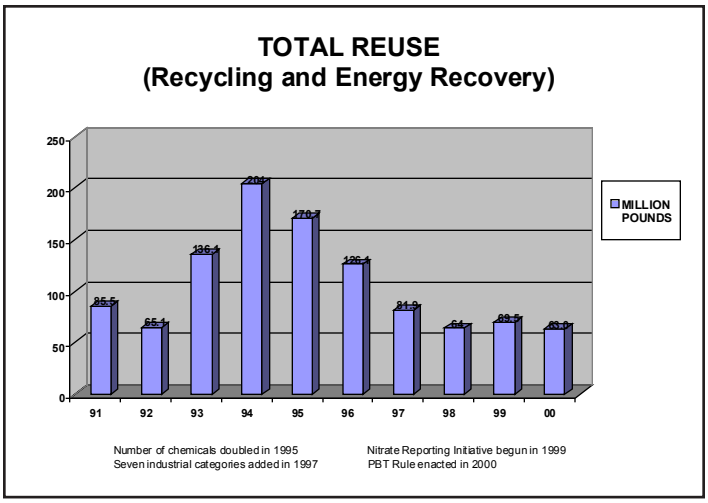

Figure 12

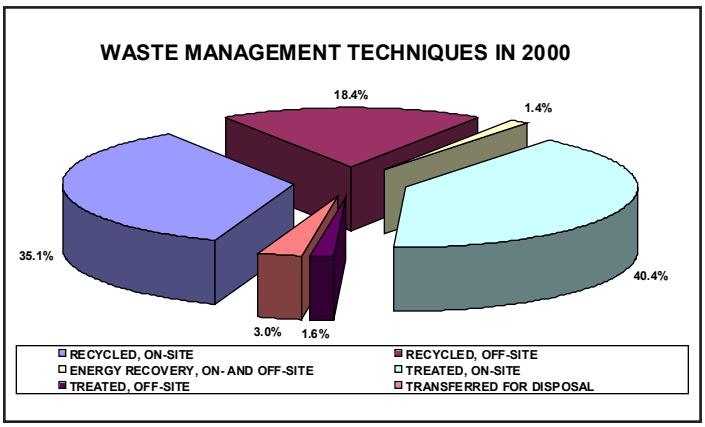

Figure 13

important means through which DEQ and industries across Oklahoma are working together to reduce the total volume of toxic chemicals managed in the State.

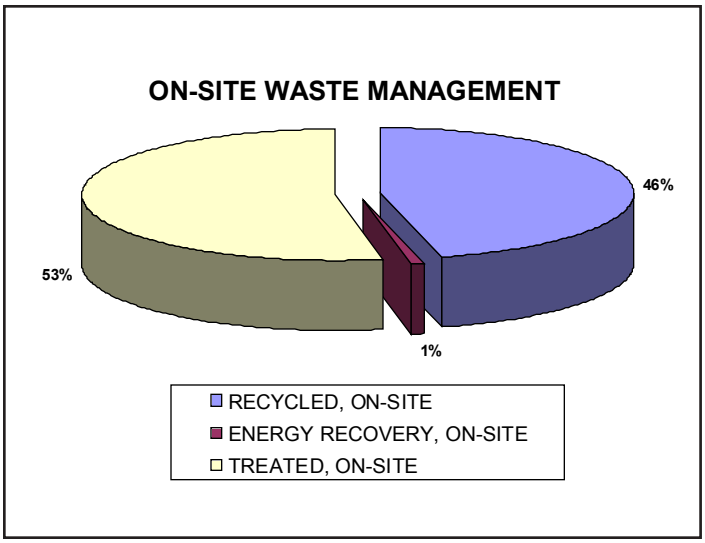

Figure 14

Treatment

Post-production treatment, both on- and off-site, neutralizes or destroys toxic chemicals in the waste stream. Frequently some type of on-site treatment is required before wastes can be discharged or transferred for disposal. A common example of this is the neutralization of spent acids in an aqueous waste. Another example of on-site treatment is the bio-degradation of organic compounds in retention ponds due to bacterial action. Total treatment in the State increased in 2000 (Figure 15) and the majority of that, 53 percent, was treatment on-site. Industrial waste handlers are responsible for the majority of off-site treatment and disposal of wastes containing toxic chemicals. As with on-site treatment, off-site treatment frequently is a requirement prior to disposal.

The 2000 Oklahoma TRI report reflects the success of voluntary pollution prevention programs sponsored by DEQ and cooperation from industries. TRI data can be used for targeting facilities, industries or specific chemicals for pollution prevention efforts.

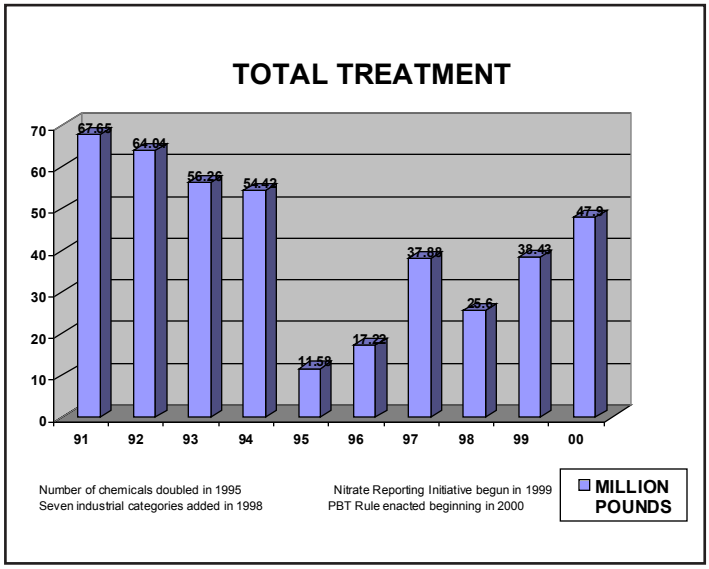

Figure 15

The Toxics Release Inventory looks at the total picture of releases, transfers as well as reuse activities; analysis of the data can be used as an index of the success of prevention measures. Nationally, the figures for total production related wastes have increased for several years. Often states report a reduction in total releases while reporting a corresponding increase in off-site transfers. This waste management system transfers toxic wastes from one location to another rather than generating less waste. Oklahoma continues to see its total releases diminish along with a decrease in off-site transfers, indicating that the total amount of toxic wastes generated in the State actually is decreasing.

DEQ provides assistance to businesses wanting to reduce the overall volume of toxic chemicals used and also offers strategies for the best reuse techniques. For additional information about pollution prevention or for business assistance in implementing source reduction measures, please contact the DEQ Customer Services Division/ Pollution Prevention Programs at 405-702-1000 or 1-800-869-1400, or visit the DEQ website at:

http://www.deq.state.ok.us/CSDnew/p2.htm

2000 Tier II Overview

The owner or operator of all facilities or sites that store hazardous substances on-site must submit a Tier II report annually for each hazardous material stored. These forms are submitted to DEQ, acting as an agent of the Oklahoma Emergency Response Commission (OHMERC), and also to the Local Emergency Planning Committee (LEPC), and the local fire department. Tier II forms require specific information describing the quantities and locations of hazardous substances as defined under the OSHA Hazard Communication Standard, which states that a hazardous chemical or substance is any substance for which a facility must maintain a Material Safety Data Sheet (MSDS). Additionally, a chemical or substance is reportable if the material is present on the site for at least 24 continuous hours in a quantity that equals to or exceeds the reporting threshold. Within the same program, EPA lists over 250 materials as Extremely Hazardous Substances (EHS) and specifies a threshold planning quantity (TPQ) for each. For an EHS the threshold for Tier II reporting is either the TPQ or 500 pounds whichever is lower. The reporting threshold for all other covered substances is 10,000 pounds. Tier II reports also provide the name and address of the owner or operator and two emergency contacts that can be used by emergency responders 24 hours a day.

Over 25,000 of the 28,000 Tier II reports received for 2000 were from Oil and Gas sites which include tank batteries as well as production sites (Table B). The correlation between total number of Tier II sites and the number of Oil and Gas Tier II sites is

RANK	COUNTY	REPORTING SITES, TOTAL	OIL AND GAS SITE, TOTAL	EHS SITES, TOTAL	TOTAL EHS, LBS.
1	Beaver	1,625	1,561	8	1,605,550
2	Kingfisher	1,440	1,393	14	3,572,550
3	Major	1,428	1,394	8	2,072,500
4	Garfield	1,231	1,152	37	32,282,150
5	Grady	1,231	1,181	27	1,327,500
6	Garvin	1,043	1,007	14	714,500
7	Canadian	1,035	970	34	2,940,000
8	Oklahoma	1,001	562	159	54,360,750
9	Roger Mills	940	932	1	500
10	Stephens	930	892	6	57,050
11	Custer	902	856	24	2,677,250
12	Blaine	860	837	11	2,156,700
13	Caddo	821	774	27	2,048,850
14	Harper	672	662	2	50,000
15	Woods	664	639	12	2,222,000
16	Texas	659	615	13	4,276,550
17	Tulsa	655	82	194	42,671,400
18	Carter	645	609	12	5,247,550
19	Woodward	628	583	8	76,802,550
20	Dewey	615	597	5	2,600,500
21	Ellis	581	566	1	500,000
22	Osage	563	514	16	48,150
23	Lincoln	546	507	14	138,150
24	Logan	524	492	8	1,562,100
25	Pittsburg	499	451	19	122,050

Table B

2000 Tier II Overview

based in the State's strong petroleum and natural gas production industries (Figure 16). A total of 1,267 reports came from sites storing one or more Extremely Hazardous Substance. Counties storing the greatest quantities of EHS are listed in Table C.

Initially there would seem to be no correlation between the quantities of stored materials as reported to Tier II and total reported releases under TRI. However when counties ranked according to Extremely Hazardous Substances stored are compared to counties with the highest number of reported TRI chemicals released, six of the nine

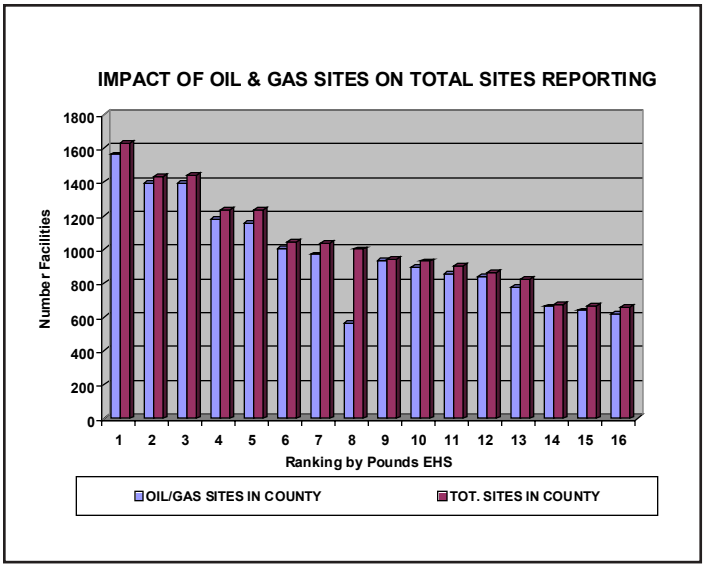

Figure 16

RANK	COUNTY	TOTAL EHS POUNDS	EHS FACILITIES
1	Rogers	88,049,850	33
2	Woodward	76,802,550	8
3	Oklahoma	54,360,750	159
4	Tulsa	42,671,400	194
5	Garfield	32,282,150	37
6	Mayes	31,012,000	27
7	Kay	10,818,650	27
8	Jackson	8,134,250	20
9	Muskogee	7,222,050	27
10	Kiowa	7,062,100	15
11	Pottawatomie	6,208,550	18
12	Grant	5,553,150	16
13	Carter	5,247,550	12
14	Cotton	5,058,550	9
15	Texas	4,276,550	13
16	Kingfisher	3,572,550	14
17	Canadian	2,940,000	34
18	Custer	2,677,250	24
19	Alfalfa	2,655,550	10
20	Dewey	2,600,500	5
21	Tillman	2,574,600	17
22	Noble	2,567,050	8
23	Washita	2,390,650	18
24	Woods	2,222,000	12
25	Blaine	2,156,700	11

Table C

counties reporting over a million pounds of TRI releases are among the ten counties with the most EHS chemicals stored. Not all of the EHS chemicals are found on the list of chemicals reportable under TRI. However, most chemicals are common to both lists and therefore both programs. While TRI and Tier II satisfy different intentions under the law, facilities reporting under both provide a great deal of chemical information for use in emergency planning. (see *Chemicals Reported in 2000*)

TRI Reporting Requirements

Industrial Sector	SIC Code
Manufacturing	2000- 3999
Metal Mining	1000's (except 1011, 1081 and 1094)
Coal Mining	1200's (except 1241)
Electrical Utilities	4911,4931 and 4939, limited to facilities that combust coal and /or oil for the purpose of generating electricity for distribution in commerce
Treatment, Storage and Disposal facilities	4953, limited to RCRA Subtitle C permitted or interim status facilities
Solvent Recovery Services	7389, limited to facilities primarily engaged in solvent recovery on a contract or fee basis
Chemical Distributors	5169
Petroleum Bulk Terminals	5171
National Defense	9711

Table D Standard Industrial Classifications Subject to Section 313

A plant, factory or other facility is subject to TRI and must annually report releases, transfers and waste management activities if it meets all three of the following criteria:

- Is included in one of the covered Standard Industrial Classification (SIC) codes (Table D). Initially, the listed codes covered manufacturing activities, however, seven additional categories were added beginning in reporting year 1998;

- Has ten or more full-time employees (or the equivalent 20,000 hours per year); and

- Manufactures, imports, processes or otherwise uses any of 603 listed toxic chemicals or chemical categories in quantities greater than the specified thresholds. The threshold quantity for toxic chemicals manufactured, imported or processed is 25,000 pounds over the calendar year. For other uses, the threshold quantity is 10,000 pounds over the calendar year. In 1995 the number of reportable chemicals doubled and the list may change again in the future.

Federal facilities that meet the threshold requirements are required to report releases annually as well and have done so since 1994.

A facility may need to report if it has one or more of the listed chemicals, even if it has no releases, because reporting requirements are based on the quantities of chemicals manufactured, processed or used rather than discharges to the environment.

Exemptions to the requirements for reporting under Section 313 are designed to reduce the burden associated with comparatively small quantities of chemicals used and apply in limited circumstances. The *de minimis* concentration exemption allows reporting of a specific chemical to be exempt if it comprises less than 1 per cent (<1 percent) of a mixture even though the total amount of the chemical exceeds the reporting threshold. However, if the Occupational Safety and Health Administration (OSHA) also defines a listed chemical as carcinogenic, the *de minimis* concentration drops to less than 0.1 per cent (<0.1 percent). The *de minimis* concentration exemption does not apply to wastes that are processed or otherwise used. Owners of leased property may not be required to report to TRI, nor are the majority of activities in analytical laboratories. Toxic chemicals that are parts of the structural components of a facility as well as chemicals used for janitorial or facility maintenance are exempted from reporting even if percentages exceed threshold requirements. Freon used in air conditioners that are solely for employee comfort is exempt, as is chlorine used to treat on-site potable water. Chemicals used in the maintenance or refueling of motor vehicles need not be reported

TRI Reporting Requirements

provided the vehicles are used only by the facility. The article exemption applies to any item that is already manufactured and whose end use is dependent to some extent by the shape or design of the item, with the provision that no 313 chemicals are released during the normal processing or otherwise use of the item at the facility. For more information about the article exemption and other exemptions, general TRI reporting and threshold quantities, contact the EPA Region 6, the Oklahoma DEQ, or visit the following website:

http://www.epa.gov/tri/general.htm

Reporting Year 2000 was the first year for implementation of the rule for Persistent, Bioaccumulative and Toxic (PBT) chemicals. Thresholds for these chemicals are far lower, no distinction is made in the reporting thresholds between manufacture, process or otherwise use, and the article exemption will not apply. A table listing PBT chemicals and a more detailed description of the program is included in the section "TRI Persistent, Bioaccumulative and Toxic Chemicals" in this report.

Facilities Reporting in 2000

For Reporting Year 2000, 323 Oklahoma facilities operating under 128 primary SIC Codes reported to TRI. EPA expanded TRI in reporting year 1998 with the addition of seven industrial categories. The added categories are linked to manufacturing by providing energy, managing products or managing wastes from the manufacturing sector.

Manufacturing facilities continue to be the majority of TRI reporters, comprising 307 of 323 facilities that reported in 2000 (Table E). Twenty-six facilities reported for the first time in 2000 with only two plants falling under an industrial sector added in 1998. However, the recently added industries continued to impact the data for Oklahoma. Coal-fired electrical plants and permitted commercial hazardous waste management facilities are two of the categories added in 1998 and together accounted for twenty-nine percent of all TRI releases in Oklahoma in 2000. Five of the ten facilities with the largest total releases for 2000 reported the first time for under the 1998 changes and all five of these were operational prior to 1998 (Table F). Together the ten industrial classifications reporting the largest total releases account for 81 percent of all TRI releases in the State (Figure 17).

The use of chemicals necessary to support Oklahoma's strong agricultural base is not reportable under TRI; but the manufacture of these chemicals and those used to produce them are covered under the program's reporting requirements. Facilities that manufacture nitrogenous fertilizers are the third largest source of releases in the State. These facilities produce hydrogen and nitrogen gases from methane (natural gas) then through a catalytic process produce ammonia which is then condensed to anhydrous ammonia and oxidized to form ammonium nitrate. Methanol is produced a secondary product of this process. Due to the very large quantities of anhydrous ammonia used and stored and the high volatility of ammonia, fugitive air emissions tend to be high. Ammonia accounts for 92 percent of all TRI chemicals used or produced by this industry sector. Due to the very large quantities of anhydrous ammonia used and stored and the volatility of ammonia, fugitive air emissions are the route for ammonia releases.

Industrial waste handlers utilizing landfills permitted under RCRA Subtitle C appear to be considerable sources of releases to the environment as reported to TRI. Although some quantities of the materials transferred to these facilities will be destroyed through treatment, the majority are disposed into highly regulated and monitored landfills. The result is a "double counting" effect in the State's TRI data That is, the majority of hazardous chemicals counted as transfers to a treatment, storage and disposal (TSD) site will be counted again in the releases reported by the TSD. Similarly, transfers of chemicals from out-of-state facilities for disposal to RCRA Subtitle C landfills located in Oklahoma are counted in the releases made for this state. Consequently Oklahoma's total land releases rose substantially due to the first time reporting by this sector. While both the toxicity and quantities of chemicals managed by this type of facility are quite large, the risk of public exposure or adverse environmental effects from disposal to a RCRA Subtitle C site should be considered extremely low.

Combustion of coal is a major source of electrical power in the State, and plants that burn coal as a source for all or part of their energy are important to electrical generation in the state. The first time reporting by this industrial category in 1998 contributed significantly to the rise in Oklahoma's figures for land releases and air emissions at that time. Nine coal fired utilities reported chemical usage above threshold levels in 1999. The reported chemicals are either components of bituminous coal or formed during its combustion (Figure 18). Overwhelmingly non-metallic compounds are released through permitted stack air emissions and these are greatly reduced through the use of in-line air scrubbers and neutralizers. Comparatively small quantities of metallic compounds are released through stack air emissions; the bulk of these compounds are found in residual ashes and released into permitted on- and off-site landfills.

Another industry utilizing large amounts of volatile chemicals is paperboard manufacturing. Pulp paper is formed into various pressed paper

Facilities Reporting in 2000

products, a process that uses large quantities of ammonia and methanol. Increasingly, methanol is used by this sector as an alternative to more toxic organo-chloride compounds. Permitted stack air releases of methanol account for over 84 percent of all releases for this industry in 2000.

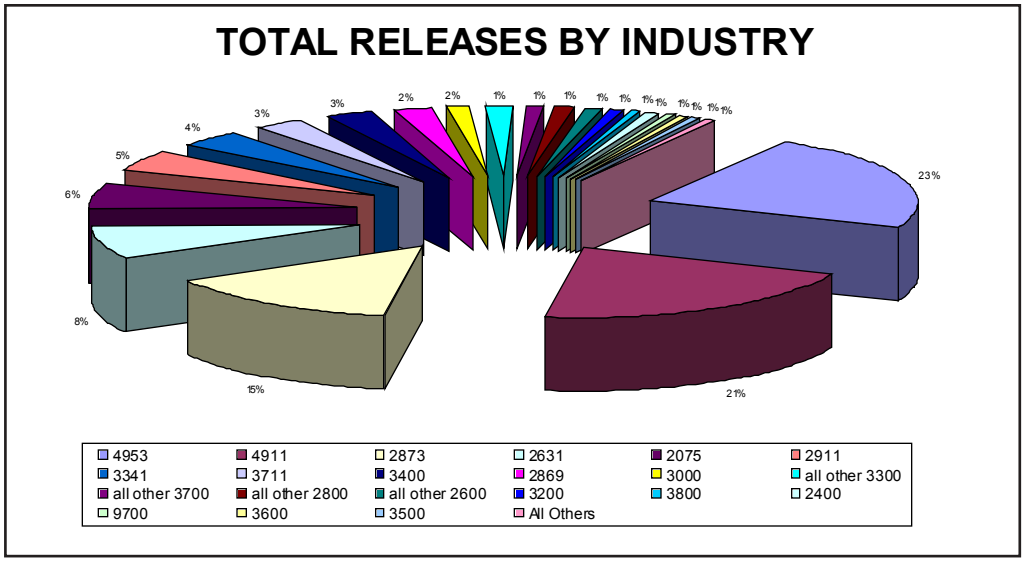

Figure 17

Soybean mills process soybeans through fermentation and extract proteins to form a variety of products for human and livestock consumption. Nitrate compounds are the largest reportable component in the waste streams of this industry and figures for releases of these compounds were greatly affected by the Nitrate Reporting Initiative begun in 1999. Increases in the reported quantities of nitrates released by this industry alone resulted in an increase in excess of three times that for all surface water releases in the State combined. As striking as the increases were this represented an improvement in the accuracy of reporting nitrates rather than an actual increase in discharges of these compounds. Through improved waste management the industry reduced its releases of nitrates by nearly 600,000 pounds in 2000, and this reduction alone accounted for the majority of decrease in Oklahoma's surface water releases from 1999 to 2000.

SIC Code INDUSTRY	Releases, lbs.
2873	6,436,103
4953	5,087,759
4911	4,166,095
2631	3,041,887
2075	1,801,529
2911	1,637,798
3341	1,307,798
3711	1,083,868
2869	976,319
3089	559,699
2621	457,712
3011	442,881
9711	348,091
3479	303,169
all others	4,655,191

Table E

Facilities Reporting in 2000

RANKING	SIC CODE	FACILITY	COUNTY	TOT. RELEASES, LBS.
1	2873	Terra Nitrogen- Catoosa	Rogers	3,326,300
2	2631	Weyerhaeuser- Valliant	McCurtain	3,041,638
3	4953	Safety Kleen- Lone Mntn.	Major	2,538,688
4	2873	Farmland Industries, Inc.	Garfield	2,418,500
5	4953	Perma-Fix Treatment Services	Tulsa	2,388,544
6	2075	Protein Technologies, Inc.	Mayes	1,801,529
7	4911	Grand River Dam Authority (OG&E)	Mayes	1,698,039
8	3711	General Motors SCG- Okla. City	Oklahoma	1,038,179
9	2899	Baker Petrolite- Barnsdall	Tulsa	987,500
10	2873	Terra Nitrogen- Woodward	Woodward	695,815
11	2911	Conoco, Inc.	Kay	583,593
12	2911	Total Petroleum Inc.	Carter	566,501
13	4911	Northeastern Station (PSO)	Rogers	547,674
14	2621	Ft. James Operating Co.	Muskogee	461,579
15	4911	Muskogee Generating Station (OG&E)	Muskogee	408,414
16	3089	Camrose Technologies	Pontotoc	394,301
17	4911	Sooner Generation Station (OG&E)	Noble	290,898
18	9711	U.S. DOD- Tinker Air Force Base	Oklahoma	287,368
19	2911	Sunoco, Inc.	Tulsa	251,439
20	2074	Producers Co-Operative Oil Mill	Oklahoma	247,785
21	4911	Western Farmers Electric Co-Operative	Choctaw	238,813
22	3411	Rexam Beverage Can Co.	Oklahoma	216,400
23	3241	Holnam, Inc.	Pontotoc	187,874
24	2421	Weyerhaeuser- Wright City	McCurtain	184,340
25	3732	US Marine/Bayliner Marine	Ottawa	167,793

Table F

Chemicals Reported in 2000

Oklahoma facilities reported the manufacture, processing or otherwise use of 128 toxic chemicals or chemical groups under TRI for 2000. The percentages of these chemicals of total TRI releases are illustrated in Figure 18. The top ten chemicals based on total releases are discussed below and ammonia, nitrate compounds, methanol, barium compounds, zinc compounds, toluene, xylenes, hydrofluoric acid, chromium compounds and hydrochloric acid aerosols accounted for 74 percent of all chemicals managed, as defined by TRI (Table G). The chemicals reported in greatest quantities for 2000 are largely a reflection of commerce in the State.

Ammonia and **nitrate compounds** remain the two materials released in the largest quantities in Oklahoma in 2000 as in previous years. These

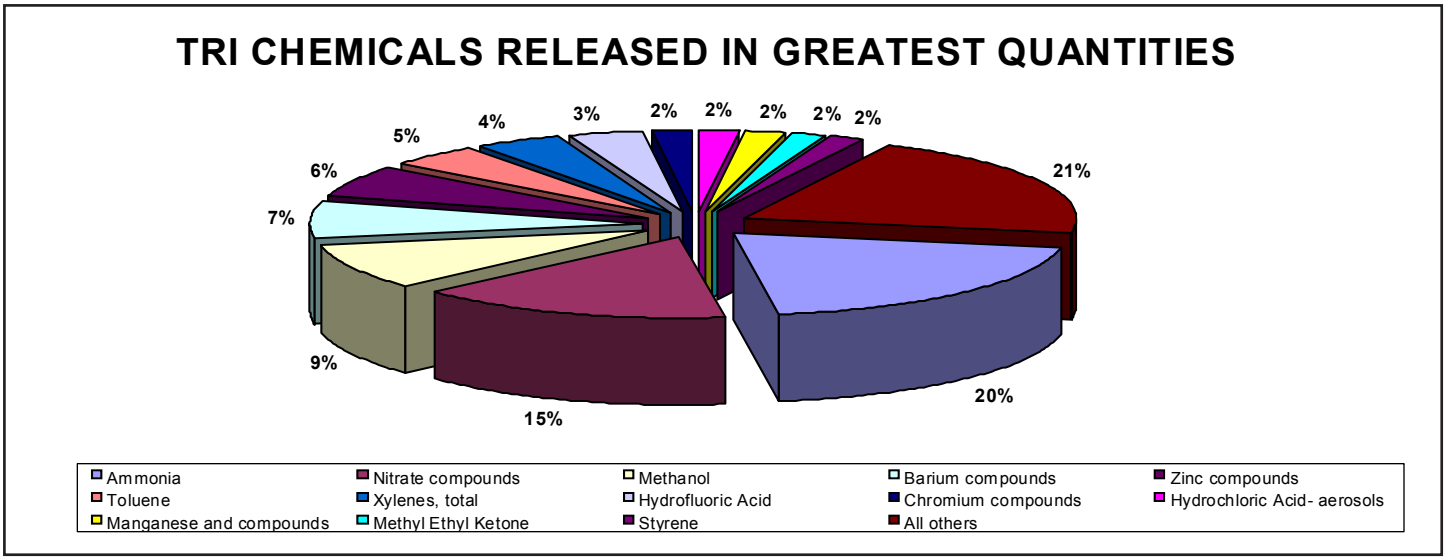

Figure 18

PBT CHEMICALS AND THRESHOLDS

CHEMICAL	TOTAL RELEASES, LBS.
Ammonia	6,473,097
Nitrate Compounds	4,899,507
Methanol	2,940,863
Barium Compounds	2,364,710
Zinc Compounds	2,040,366
Toluene	1,504,158
Xylenes, total	1,335,700
Hydrofluoric Acid	1,097,960
Chromium Compounds	697,284
Hydrochloric Acid- Aerosols	611,467
Manganese and Compounds	574,350
Methyl Ethyl Ketone	572,846
Styrene	564,468
All others	6,629,123

Table G

nitrogen-based compounds are components of fertilizers and stock feed stuffs and accounted for 35 percent of all toxic chemicals released in Oklahoma in 2000.

Due to its volatility, the majority of ammonia releases are emissions to air. Ammonia gas produces highly irritating and corrosive vapors and is an inhalation and dermal hazard. Skin contact with ammonia vapor or compressed gas may result in cryogenic burns as well. Production of nitrogen fertilizers uses anhydrous gaseous ammonia, which is hydroscopic and therefore extremely damaging to the mucus membranes of the eyes and respiratory tract. Ammonia gas is used by other industries as a refrigerant, while ammonia solutions are used in paper pulping operations and food processing (Figure 19).

Chemicals Reported in 2000

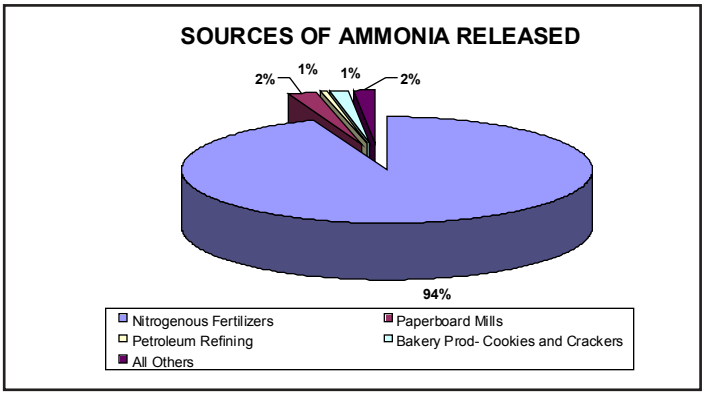

Figure 19

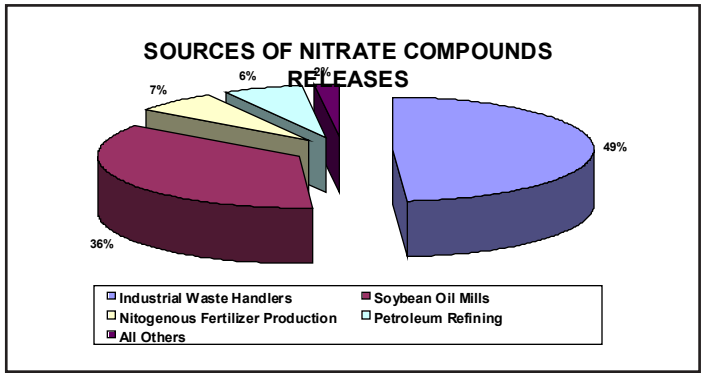

Figure 20

In the previous year, nitrate releases rose significantly in Oklahoma and the rest of the U.S. as a direct result of the EPA enforcement activity known as the Nitrate Initiative. The Nitrate Initiative activities sought to improve the accuracy of nitrate release figures by addressing the under reporting of water dissociable nitrate compounds. At ambient temperatures, nitrates exist as solid salts containing the nitrate ion, such as sodium nitrate, silver nitrate and ammonium nitrate. However, in aqueous solutions, the form in which most nitrate compounds are used and released, the compounds dissociate to form negatively charged nitrate ions and the corresponding cations. The production of water dissociable nitrates in waste streams, frequently formed by the neutralization of nitric acid, often was excluded from the calculations for numbers reported to TRI. Additional clarification stated that nitrate anions formed by the dissociation of any nitrate-containing chemical are reportable, regardless of whether the compound itself is listed under Section 313. As a result, Oklahoma saw a substantial increase in the overall numbers reported for nitrates and a consequential and dramatic increase in the figures for releases to surface waters, POTWs and landfills as well as in treatment figures. However, efforts to reduce the quantity of nitrate compounds discharged to the environment figured largely in the overall reduction in releases to surface waters and POTWs (see “2000 TRI Overview”). In particular, soybean mills reported a drop of over 1,000,000 pounds in 2000 from 1999, which is especially significant as this industry is the largest manufacturing sector of nitrate wastes (Figure 20).

Solutions of nitrate compounds can be disposed into deep underground injection wells, and in fact, injection is the means of disposal used most often by industrial waste management operations handling these chemicals. This method of disposal presents an extremely small risk of human exposure. Certain geological formations may cause naturally high concentrations of nitrates in potable groundwater. Prolonged ingestion of high concentrations of nitrates, which oxidize the iron in hemoglobin to form methemoglobin in the blood, leads to methemoglobinemia (“blue-baby” syndrome). Children, and in particular infants under age six months, are most susceptible to this disease and most likely to suffer long term deleterious effects from it.

Methanol, also known as methyl alcohol or wood alcohol, is a common industrial solvent and was reported by 33 facilities for 2000. It is highly volatile and flammable, and virtually all releases of methanol are permitted air emissions. The primary

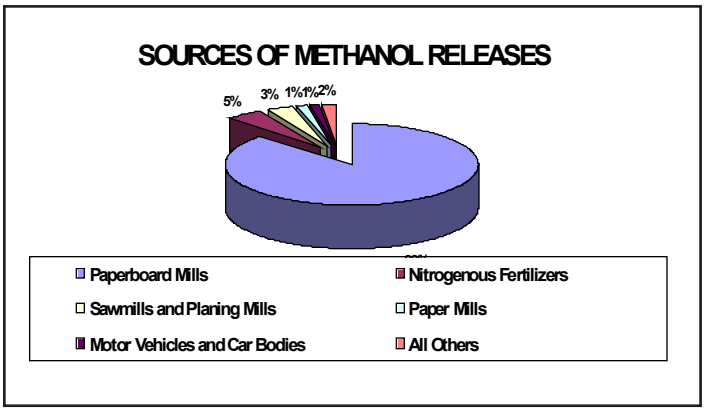

Figure 21

users of methanol in Oklahoma are the pulping and paper production industries (Figure 21). Methanol also is produced as a secondary product by ammonia fertilizer plants. Exposure to vapors can result in eye irritation, headaches, fatigue and drowsiness; exposure to high doses may cause temporary coma. Methanol is highly water soluble and ingestion of the compound can cause permanent blindness, liver damage and death but, the risk of this means of exposure from environmental contaminants is very low.

Barium is a naturally occurring metal and small quantities of **barium containing compounds** may be present normally in the soils of Oklahoma. Barium compounds have varied industrial uses; however, under TRI reporting requirements in Oklahoma for 2000, these chemicals are reported chiefly as non-combustible components of coal found in the ash produced by coal-fired electrical plants (Figure 22). Fly ash along with other barium

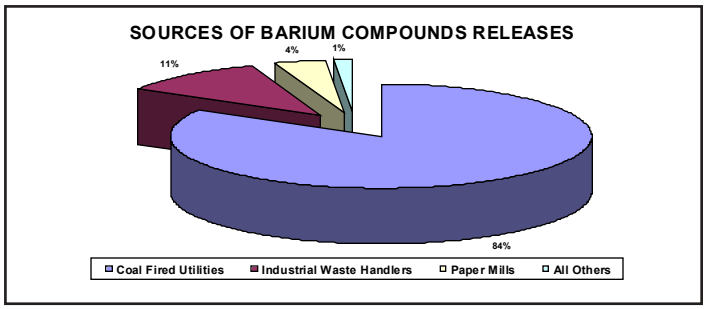

Figure 22

compounds most frequently are disposed to land through the use of permitted sanitary landfills, RCRA Subtitle C regulated disposal facilities and surface impoundments. The ability of barium compounds to create health or environmental hazards is dependent on the water solubility of individual compounds. Generally relatively high concentrations of barium are required to be toxic or hazardous. Ingestion is the most common means of exposure, although the dust of dry barium compounds may pose an inhalation hazard. Potential health effects from exposure to high concentrations of barium or barium compounds are gastric irritation, muscle fatigue, cardiac arrhythmia, and damage to internal organs. Barium sulfate (barite) is excluded from TRI reporting.

Zinc compounds occur naturally in the earth's crust and zinc is a nutritionally essential trace metal in humans. Zinc compounds are widely used in the manufacture of metal alloys, paint and dyes, ointments, wood preservatives and wire coatings and also are present in the residual ash of coal combustion (Figure 23). Exposure occurs through ingestion or inhalation. Ingestion of zinc or zinc compounds at levels 10-15 times the Required Daily Allowance (RDA) is deleterious to health. Excess ingestion over a short-term exposure results in gastric disturbances; long time exposure

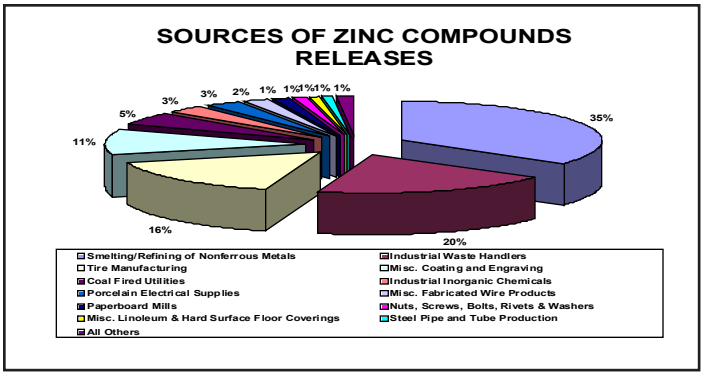

Figure 23

may result in anemia, pancreatic damage, and changes in blood cholesterol levels. Short-term inhalation of zinc fumes or dust can cause a disease called metal fume fever that has flu-like symptoms and is largely reversible. The long-term effect of inhaling elemental zinc or zinc compounds is unknown. Disposal through RCRA Subtitle C landfills is the most common source of releases in Oklahoma.

Toluene, also known as methyl benzene or toluol, is an aromatic compound and is a clear, colorless liquid at ambient temperature and pressure with a sweet, pungent odor. It is a widely used industrial solvent, a component of paints, inks, adhesives and cleaning agents, and used for chemical extractions (Figure 24). During petroleum refining it is isolated and back blended into fuels to raise octane levels. Toluene also is a by-product of styrene production. Because of its high volatility, the majority of toluene released to the environment is through stack or fugitive air emissions and inhalation of fumes is the primary means of

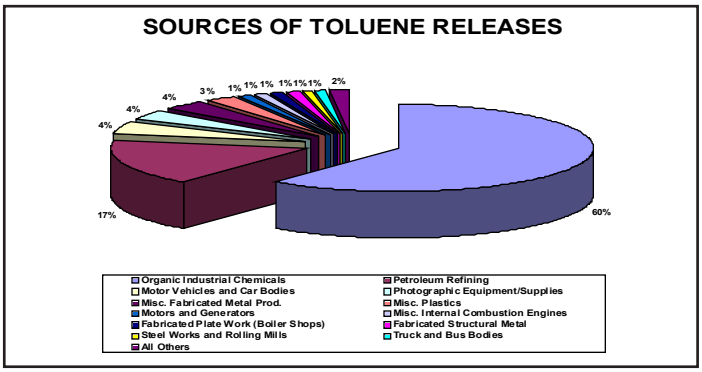

Figure 24

exposure, although it may be absorbed dermaly as well. Continuous exposure or exposure to higher concentrations may cause unconsciousness and eventual asphyxiation. Long-term exposure eventually results in kidney and brain damage. Toluene is not classified as a known or potential carcinogen; however, it is a possible mutagen and highly flammable.

For the purpose of this report, **xylenes** were considered together as a single compound without distinguishing between the three isomers: ortho-, meta-, and para-xylene (1,2-, 1,3- and 1,4-xylene respectively). Xylenes are aromatic compounds often found in mixtures with ethyl benzene. These compounds are highly volatile and flammable with boiling points so near one another that separation of the isomers by conventional methods is difficult. At ambient temperature and pressure, xylenes are clear liquids with a sweet odor. In Oklahoma mixed isomer solutions of xylenes are most commonly used. The mixture is a widely used industrial solvent with uses in many industries and 46 facilities in the State report its use in quantities exceeding the threshold levels (Figure 25). It also is a component of paints and refined petroleum hydrocarbons. Releases occur to air and inhalation is the means of exposure, although they may be absorbed through the skin. Xylenes are central nervous system depressors causing dizziness, motor disturbances, nausea and loss of consciousness as a result of acute exposure. High concentrations may cause asphyxia. Chronic exposure may damage bone marrow and thereby cause depressed blood cell counts.

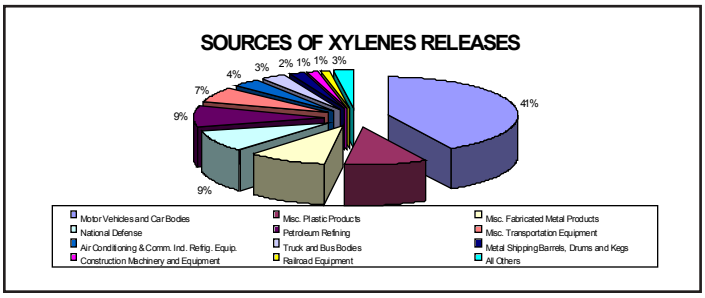

Figure 25

Hydrogen fluoride is a colorless gas with a sharp, acrid odor. It is hygroscopic and readily dissolves in water to form hydrofluoric acid. In its gaseous state, releases occur to the air and inhalation is the means of exposure. At low levels hydrogen fluoride is an eye, skin and respiratory irritant as hydrofluoric acid is formed when the gas comes into contact with moisture in these organs. Acute inhalation exposure at high concentrations may cause pulmonary edema and cardiac arrhythmia. Hydrofluoric acid is highly corrosive and may cause

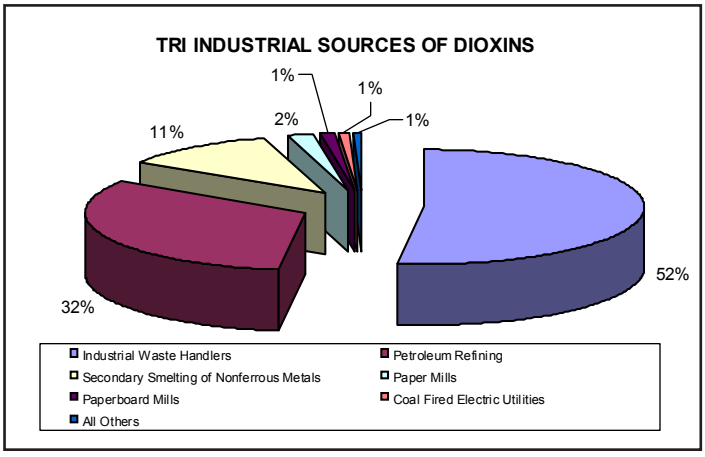

Figure 26

severe burns. Hydrogen fluoride is formed during coal combustion and this is the largest source of releases in the State (Figure 26). Other common uses are as a hardener or catalyst, or an agent to etch glass.

Chromium compounds are classified by the charge (valence) of the chromium atom in the compound. The distinction is important because, as with many classes of related chemicals, toxicity varies greatly among compounds. For example,

chromium (III) compounds include chromium chloride, chromium phosphate, ferrochromite and chromium sulfate, whereas hexavalent or chromium (VI) compounds include chemicals such as ammonium dichromate, barium chromate, chromium trioxide and potassium dichromate. Chromium compounds are classified as known chemical carcinogens, although the evidence is based on selected hexavalent chromium compounds. Chromium (VI) compounds also are far more irritating and corrosive than trivalent chromium compounds, skin ulcerations result from dermal contact and respiratory irritation and distress occur from inhalation exposure. Ingestion may result in necrosis of the renal tubes. Trivalent compounds occur naturally in the environment, however, chromium (VI) compounds are produced during industrial processes. Although there are many applications for chromium compounds of all types in industry, chromium containing stainless steel is by far the largest. Harmful exposure to chromium compounds from alloys is minimal. The exception is inhalation from steel cutting and grinding operations, although deleterious effects result from mechanical as well as chemical action. The majority of chromium compounds releases in the Oklahoma are actually disposals to RCRA Subtitle C landfills and the risk for exposure is extremely low (Figure 27) .

Hydrochloric acid is extremely corrosive and is always handled in solution, usually aqueous. However, even dilute solutions of hydrochloric acid will corrode most metals and are extremely damaging to skin and mucus membranes. TRI reporting concerns only **hydrochloric acid aerosols**, also known as "1995 and after", referring to a 1995 clarification that specifies only aerosols of the chemical are reportable. An aerosol of hydrochloric acid is considered to be any mist, vapor, gas, fog or other airborne form of particle size. Sprayed or distilled acid is covered, as is hydrogen chloride gas. Hydrochloric acid is a by-product of coal combustion, and coal fired electric utilities were the source of 55 percent of releases in 2000 (Figure 28). However, gases generated by coal combustion are treated by in-line or stack scrubbers greatly reducing concentrations of hydrochloric acid and other chemicals prior to release as permitted stack air emissions.

The list of chemicals and chemical families reportable under TRI continues to change. Beginning with Reporting Year 1995, the list increased from 313 to over 600. Effective with RY 1999, phosphoric acid was deleted from the list. The PBT Rule is in effect for RY 2000 (see Persistent, Bioaccumulative, Toxic Chemicals). Also effective with RY 2000, vanadium, previously reported as "fume or dust" only, was expanded to include any vanadium metal except as contained in alloys. Petitions to delist methyl ethyl ketone (MEK), methyl isobutyl ketone (MIBK) and acetonitrile were denied for RY 2000. Concerned parties outside of the EPA may petition the agency to add or delete chemicals from the list.

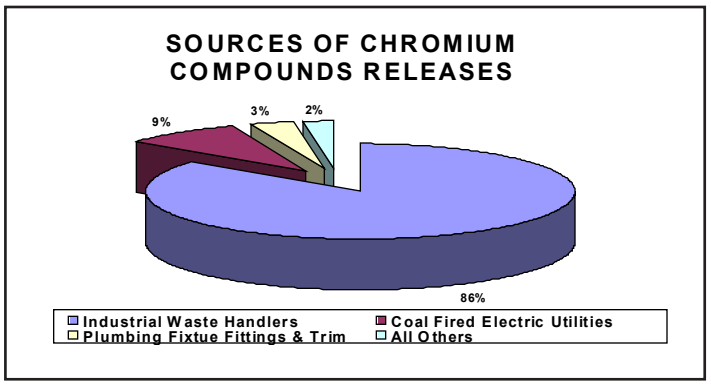

Figure 27

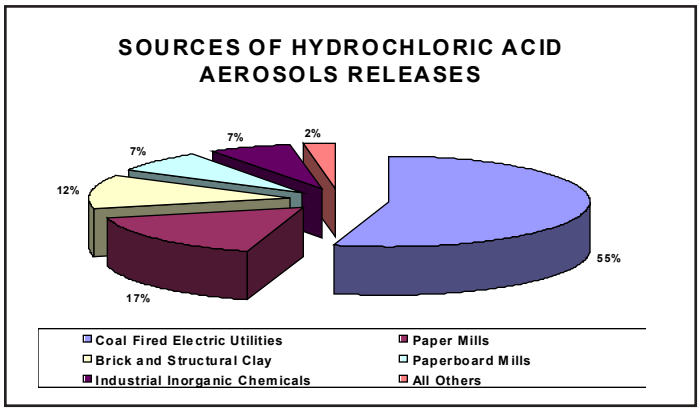

Figure 28

Chemicals Reported in 2000

Facilities and sites in Oklahoma reported 132 Extremely Hazardous Substances as defined by Tier II reporting and 1,782 materials not classified as EHS. The top ten chemicals by total pounds reported are found in Table H. As would be expected from the number of oil and gas sites reporting for 2000, crude oil is the material stored in greatest quantities in the State. Seven of the ten materials reported in greatest quantities are

RANK	MATERIAL/CHEMICAL	TOT. POUNDS STORED
1	crude oil	22,522,071,000
2	propane	9,478,731,100
3	diesel fuel	8,977,221,100
4	gasoline	7,513,615,550
5	coal	5,081,550,000
6	asphalt	3,607,705,500
7	toluene	3,032,805,500
8	fly ash	2,281,550,000
9	ethylene glycol	1,401,500,000
10	ammonium chloride	750,000,000

Table H

mixtures of several, sometimes many, chemical compounds rather than one discreet chemical. Although none of these ten materials is listed as an EHS, all posses well documented hazards (Figure 29).

The EHS chemicals reported in greatest quantities are shown in Table I. As in TRI reporting, ammonia is the EHS stored in greatest amounts due to agricultural activity (Figure 30). The other four largest EHS chemicals are not reportable under TRI and, therefore, no correlation is seen. However, cyclohexamine is utilized in petroleum refining as are many of the TRI chemicals reported.

Ammonia, its sources and effects were discussed in the TRI section. The remainder of the five largest EHS chemicals, according to quantities stored, are considered below.

More **sulfuric acid** is produced in the United States than any other chemical and its industrial uses are many. Among them are lead-acid batteries, petroleum refining, electroplating and

RANK	CHEMICAL	TOTAL POUNDS REPORTED
1	ammonia	783,065,550
2	sulfuric acid	56,565,550
3	nitric acid	31,565,550
4	cyclohexylamine	30,550,500
5	chlorine	6,515,550
6	phenol	1,870,100
7	sulfur dioxide	1,515,550
8	hyrdrofluoric acid	1,025,050
9	hydrogen peroxide	1,015,550
10	formaldehyde	1,015,050

Table I

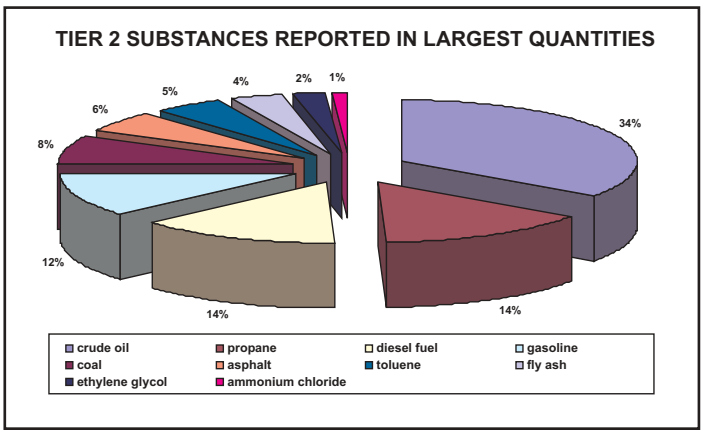

Figure 29

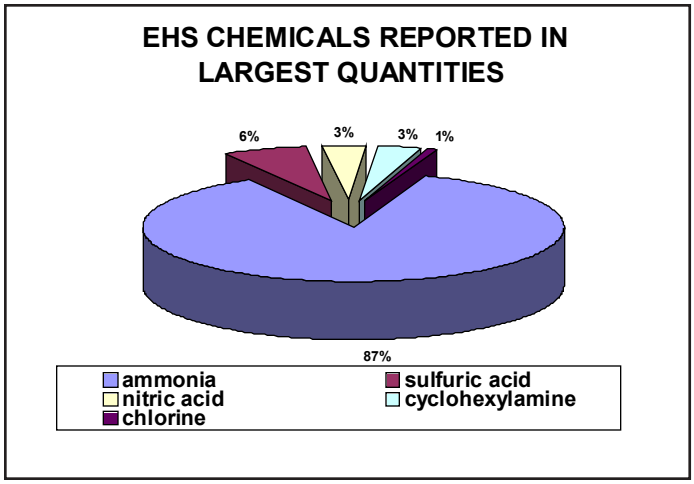

Figure 30

production of rayon, film, explosives, dyes and wood preservatives. It is a clear, colorless, oily liquid and highly corrosive even in aqueous solutions. Sulfuric acid is highly corrosive and a strong oxidizer. It can combust or explode upon contact with acetone, alcohols and other specific organic materials and reacts violently with water. When heated it produces fumes of highly toxic sulfur trioxide. Blindness can occur if sulfuric comes in contact with eyes and excessive inhalation of micro droplets can cause pulmonary edema. Dermal contact leads to severe burns. While quantities of sulfuric acid stored are reportable to Tier II, only aerosols are reported to TRI.

Nitric acid is a clear, oily liquid that may be colorless, yellow or red and has a choking, acrid odor. The largest use of nitric acid is for the manufacture of ammonium nitrate fertilizer. Other uses include photo engraving, metal etching and synthesis of organic chemicals. It is highly corrosive and can attack some forms of plastic and rubber. Poisonous nitrous oxide fumes are produced when heated and mixture with steam or water produces toxic, corrosive and flammable vapors. It is a strong oxidizer and will react explosively with metal powders, cyanides, sulfides, turpentine, acetonitrile and many reducing agents. Acetone, arsine and other chemicals are oxidized explosively by fuming nitric acid. Nitric acid will cause severe burns to any tissues with which it comes into contact. Inhalation of nitric acid fumes can cause pulmonary edema and pneumonitis and acute exposure to high concentrations can cause shock and cardiac insufficiency. Use, releases and waste management of nitric acid are not reportable under TRI.

Cyclohexyl amine, also known as aminocyclohexane and hexahydroanaline, is a colorless to pale yellow liquid with a strong “fishy” (amine) odor. It is flammable with a flash point of 110 degrees Fahrenheit. It is a somewhat unstable compound and reacts violently with nitric acid and other oxidizers. When cyclohexyl amine is heated to decomposition, highly toxic fumes are produced. Most common means of exposure are dermal contact and inhalation. It is a contact irritant for skin, eyes and the respiratory tract. Acute inhalation exposure causes nausea and narcotic effects. This chemical is a suspected mutagen and long-term exposure should be avoided. Cyclohexyl amine is used in pesticides and herbicides and also as a surfactant and emulsifier, especially in boilers and oil field operations. It also is used in the synthesis of paints, pigments, plasticizers and rubber chemicals. This chemical is not reportable to TRI.

Chlorine is a toxic chemical familiar to most people. Chlorine gas, which is yellow-green with a pungent, irritating odor, is commonly used as a disinfectant especially for public water supplies. Dissolved in water it forms hydrochloric or hypochlorous acids or under certain conditions sodium hypochlorite (bleach). Inhalation at concentrations of 1,000 ppm and greater causes fatal pulmonary edema and cardiac arrest. The extent of damage from acute exposure at lower levels depends on the duration of the exposure as well as concentration and symptoms can range from mucus membrane irritation to chemical pneumonia. If acute exposure to chlorine is survived, recovery is usually rapid and complete. Long term exposure causes reductions in red blood cell counts and increases the fragility of these cells; however these conditions are known to reverse within six months from the cessation of exposure. Chlorine use, releases and management are reportable to TRI, and in 2000 industrial facilities covered under this program reported 17,369 pounds of chlorine released.

The information provided on Tier II forms about dangerous materials can help to protect emergency responders and remains an important function of the Hazardous Chemical Inventory.

TRI Persistent, Bioaccumulative and Toxic Chemicals

The most significant recent change to the list of chemicals reportable to TRI was the 1999 final rule on Persistent, Toxic and Bioaccumulative chemicals (64 FR 58666). Chemicals designated as persistent, bioaccumulative and toxic (PBT) are of particular concern as they have been demonstrated to be highly toxic, are difficult to destroy, tend not to degrade but persist in the environment and accumulate in the body tissues of humans and wildlife (bioaccumulate). Implementation of the PBT rule should be viewed as a step in addressing one of the chief limitations of TRI data, specifically, the wide variability in toxicity between different chemicals. Beginning with 2000, reporting thresholds for eighteen chemicals classified as persistent, bioaccumulative, toxics were lowered substantially. Each of the lower thresholds also takes into account risks of exposure to the particular chemical. Seven chemicals and two chemical families previously not reportable under Section 313 were added to the list as part of the final PBT rule (Table J). The first PBT list is composed of organo-chlor pesticides, other highly chlorinated or brominated aromatic compounds, chemicals with multiple, linked aromatic rings (polyaromatic compounds) and two heavy metals reported as elements or compounds.

Manufacture, process and otherwise use thresholds

Aldrin	100 lbs./yr.
Methoxychlor	100 lbs./yr.
Pendimethalin	100 lbs./yr.
Polycyclic Aromatic Cmpds.	100 lbs./yr.
Tetrabromobisphenol	100 lbs./yr.
Trifluralin	100 lbs./yr.
Chlordane	10 lbs./yr.
Benzo(g,h,i) perylene	10 lbs./yr.
Heptachlor	10 lbs./yr.
Hexachlorobenzene	10 lbs./yr.
Isodrin	10 lbs./yr.
Mercury	10 lbs./yr.
Mercury Cmpds.	10 lbs./yr.
Octa-styrene	10 lbs./yr.
PCB's	10 lbs./yr.
Pentachlorobenzene	10 lbs./yr.
Toxaphene	10 lbs./yr.
Dioxin and dioxin-like cmpds.	0.1 gm/yr.
Lead and lead cmpds.	10 lbs./yr.

Table J

The lowered thresholds apply to all reportable activities and no alternate thresholds for 'otherwise use' are given. Use of Form A is disallowed for any PBT chemical. The *de minimis* concentration exemption is not applicable for any PBT chemical, with the exception of lead containing alloys. A separate rule (66 FR 4500) which classified lead and lead compounds as PBTs and lowered thresholds for both was published in 2001 and becomes effective with RY 2001. The new thresholds do not apply to lead contained in stainless steel, brass or bronze alloys. When lead or lead compounds contained in these alloys are reported, the 25,000 lb. threshold for produce and manufacture and the 10,000 lb. threshold for otherwise use remain in effect.

Oklahoma companies reported eight Persistent Bioaccumulative Toxic chemicals for 2000 (Table K). As predicted, the implementation of the PBT final rule minorly impacted total numbers for the State. Only 1.6 percent of all TRI releases and 2.5 percent of total production related wastes reported in Oklahoma for 2000 were from PBTs. The slightly greater number of facilities reporting and number of reports received in 2000 can be attributed to PBT reporting requirements.

Lead and lead compounds were the PBT chemicals reported in greatest quantities for 2000. Production of steel wire, nails and spikes accounted for 84 percent of **elemental lead** releases in 2000 (Figure 31); the manufacture of plumbing fixtures accounted for an additional 5 percent. Ninety-five percent of all **lead compounds** 'releases' were permitted land disposals at highly regulated RCRA Subtitle C hazardous waste facilities. (Figure 32). Releases to these sites have virtually no impact on the environment or human health. Secondary smelting of nonferrous metals, which includes activities such as the refining and smelting of zinc, tin or precious metals or silver

TRI Persistent, Bioaccumulative and Toxic Chemicals

	# Facilities	Total Releases	Air Releases	Land Releases	UG Injection Releases	Water Releases
Benzo(g,h,l) perylene	13	164	150	13	0	1
Dioxins *	18	440.000 gm	70.000 gm	37.000 gm	0.000	0.000
Lead**	22	2,068	1,539	250	0	279
Lead cmpds. **	7	454,153	2,256	451,290	570	37
Mercury	4	71	70	0	0	1
Mercury cmpds.	16	2,775	1,274	1,499	0	2
Polychlorinated Biphenyls	1	6,092	2	6,090	0	0
Polycyclic Aromatic Cmpds.	23	3,089	2,859	221	0	9
Totals, pounds		468,413	8,150	459,364	570	329

	Energy Recov.	Recycling	Treatment	POTW Transfers	Transfers-Disposal	TPRW
Benzo(g,h,l) perylene	2,364	12	10	0	49	2,599
Dioxins *	0.000	0.000	14.000 gm	0.000	78.000 gm	532.000 gm
Lead**	0	665,778	2,947	52	780,881	1,451,726
Lead cmpds. **	0	754,070	961	5	692,734	1,901,923
Mercury	0	1	0	0	2	74
Mercury cmpds.	0	0	2	0	845	3,622
Polychlorinated Biphenyls	0	0	0	0	0	6,092
Polycyclic Aromatic Cmpds.	78,013	105,507	128	102	72,530	259,369
Totals, pounds	80,377	1,525,368	4,048	159	1,547,041	3,625,407

in pounds except as noted
**in grams*
***reduced threshold not in effect for RY 2000*

Table K

recovery from used photographic film, was the source of approximately 3 percent of lead compounds releases.

This was the final year that the 25,000-lb./10,000-lb. thresholds for these chemicals applied. While the number of facilities reporting lead and lead compounds is expected to increase for 2001 when the new thresholds come into effect, total quantities for releases, treatment, recycling and disposal should not increase significantly. Those industries reporting the greatest usage and waste

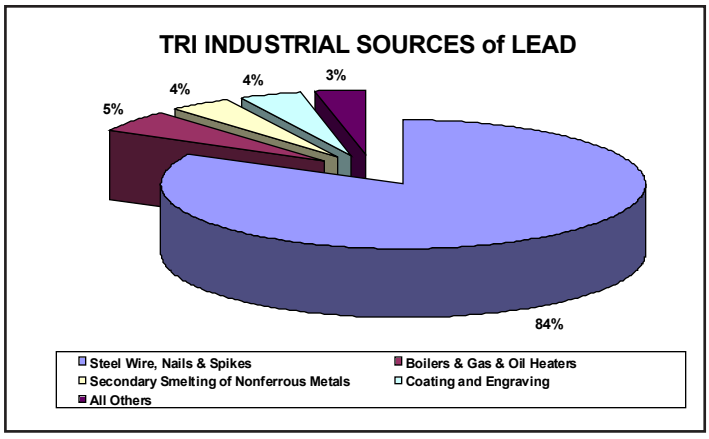

Figure 31

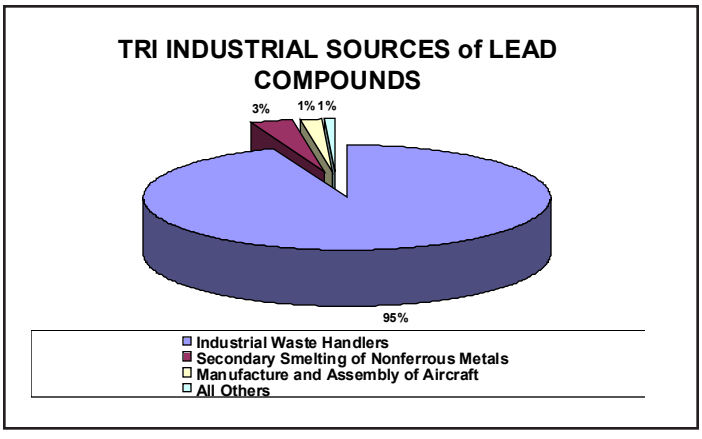

Figure32

management for lead and compounds use primarily alloys and therefore will continue to report under the higher thresholds.

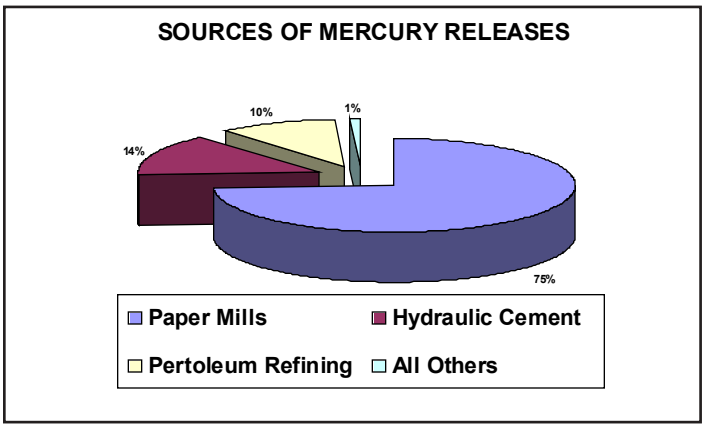

Figure 33

All reported releases of **polychlorinated biphenyls** (PCB's) were permitted disposals to RCRA Subtitle C hazardous waste sites. Similarly, 42 percent of all **mercury compounds** released were permitted disposals at these highly regulated facilities (Figure 33). Coal-fired utilities and concrete and cement facilities also accounted for releases of mercury compounds. Paper milling was the source of 75 percent of **elemental mercury** releases (Figure 34), followed by concrete and cement facilities and petroleum refining. While the hazards of mercury and compounds are well documented, it is important to keep the scale in perspective. Combined releases of mercury and mercury compounds totaled less than 10,000 pounds or about three one thousandths of one percent (.0003 percent) of the total releases reported in Oklahoma for 2000.

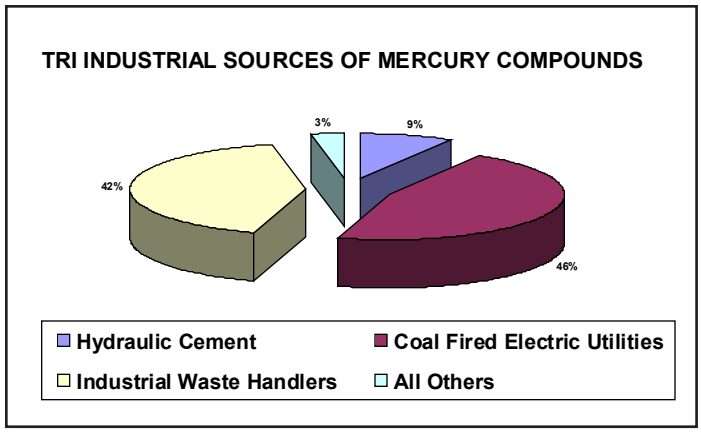

Figure 34

Polyaromatic compounds (PACs), also known as polynuclear aromatics (PNAs) or polycyclic aromatic hydrocarbons (PAHs) describe a group of related chemicals that generally occur as complex mixtures rather than as any individual compound. These chemicals are byproducts of incomplete combustion of fossil fuels or incineration of organic materials such as wood or garbage. Polyaromatics are natural components of crude oil and are produced during petroleum refining (Figure 35). Carbon black used in tire manufacturing is also a source of releases. While **benzo(g,h,i)perylene** is a polyaromatic compound, it is the only one of these chemicals

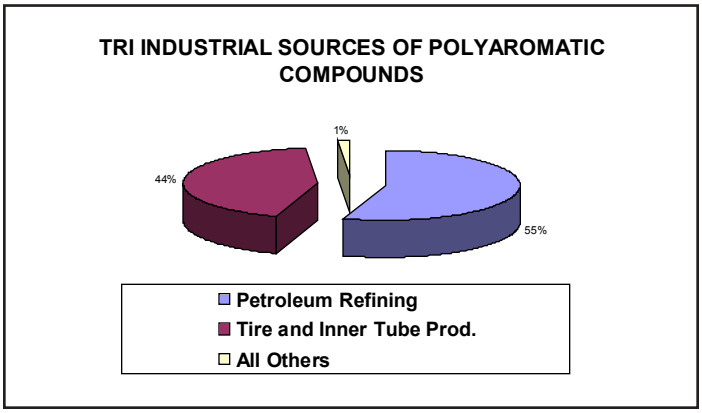

Figure 35

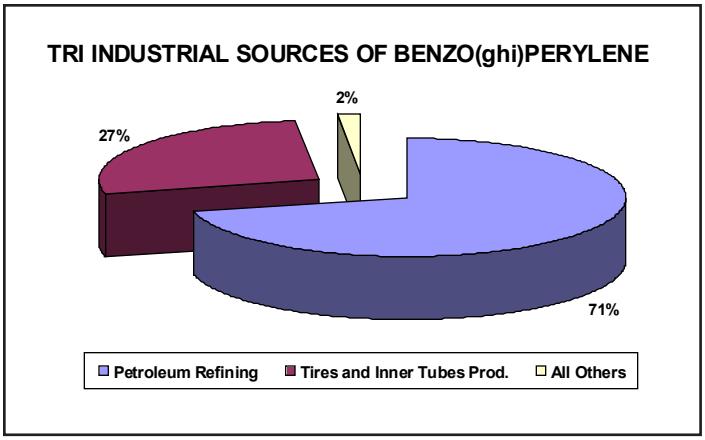

Figure 36

listed separately as a PBT. There are no commercial uses of benzo(g,h,i)perylene and, like other PACs, it is produced by incomplete combustion or burning. As would be expected, sources of benzo(g,h,i)perylene releases are similar to those for polyaromatics in general (Figure 36).

Dioxin and dioxin like chemicals refer to a group of chlorinated aromatic compounds containing the dioxin linkage, a double substitution of oxygen in an aromatic ring. These chemicals once were used as defoliants; however, in the past 20 years the only dioxins manufactured commercially in the United States are extremely small quantities for research purposes. Dioxins are the only TRI chemicals with a threshold expressed in grams. Releases of dioxins in 2000 totaled only 440 grams (0.97 pounds), and total production related wastes equaled 532 grams (1.07 pounds) for the entire state (Table K). The most commonly known dioxin,

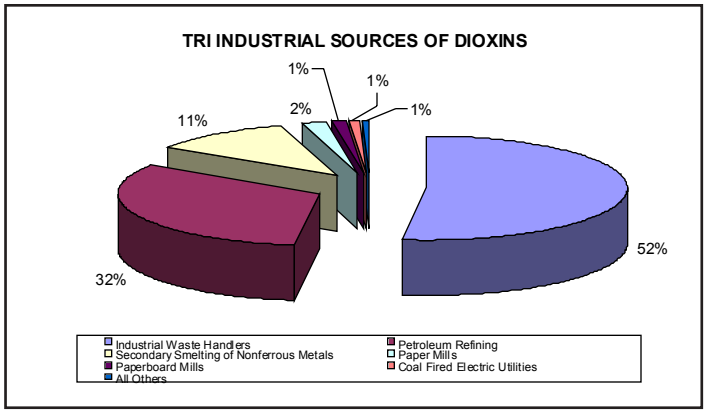

Figure 37

tetrachlorodibenzo-p-dioxin (2,3,7,8-TCDD) is highly toxic and classified as a known carcinogen; however, as with most families of chemicals, there is a wide variability in toxicity between 2,3,7,8-TCDD and other congeners. TRI reporting for dioxin and dioxin-like compounds requires that the distribution between seventeen of the most chlorinated dioxin compounds be reported as well. Therefore, no assumptions should be made concerning the toxicity of reported dioxins without analyzing the distribution of compounds. Of the less than one pound of dioxins reported released in 2000, half of all releases or slightly less than 0.5 pound were permitted disposals to RCRA Subtitle C hazardous waste facilities (Figure 37). Dioxins are incidentally produced as byproducts from combustion of fossil fuels or incineration of organic materials, formed as paper pulp is bleached or appear as impurities in chlorinated pesticides.

Modifications and additions to the list of PBT chemicals should be expected. For example, EPA deferred a decision in the final rule on dicofol, a pesticide, until the agency further evaluates data on its persistence. Cobalt and cobalt compounds were considered for the initial PBT list as well, however, EPA deferred the decision pending more investigation into the bioaccumulative properties of these chemicals. As with previous expansions in TRI reporting, future changes in PBT reporting will make the data more representative and thereby better inform the public of chemical risks in the community.