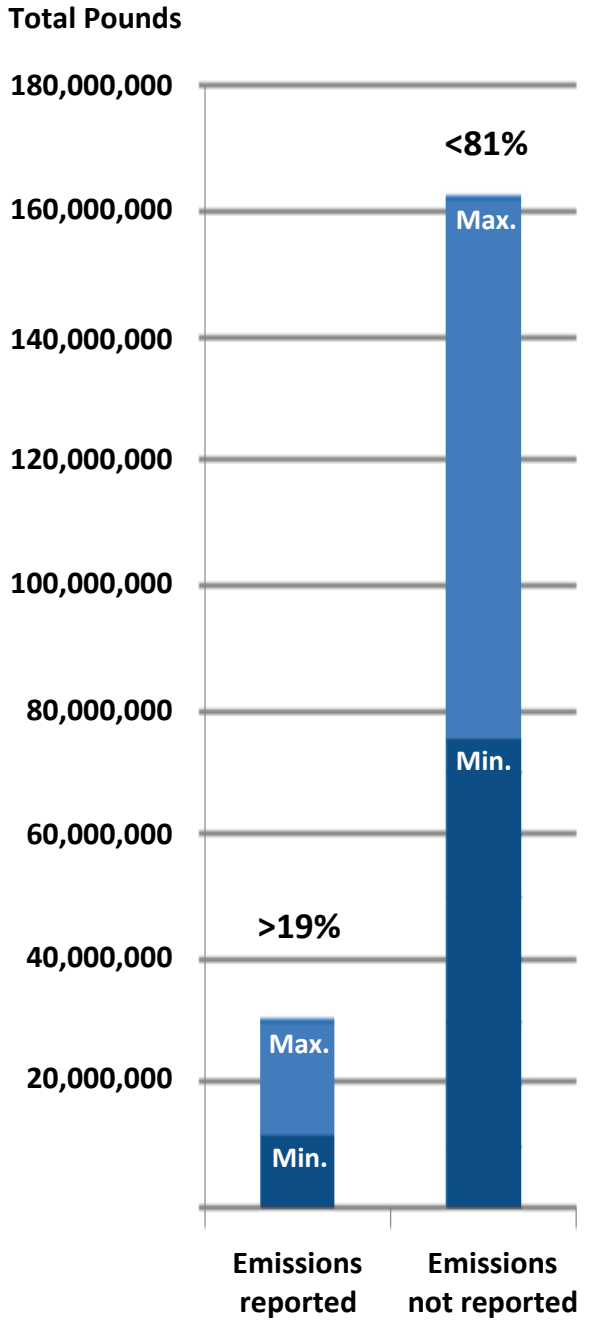
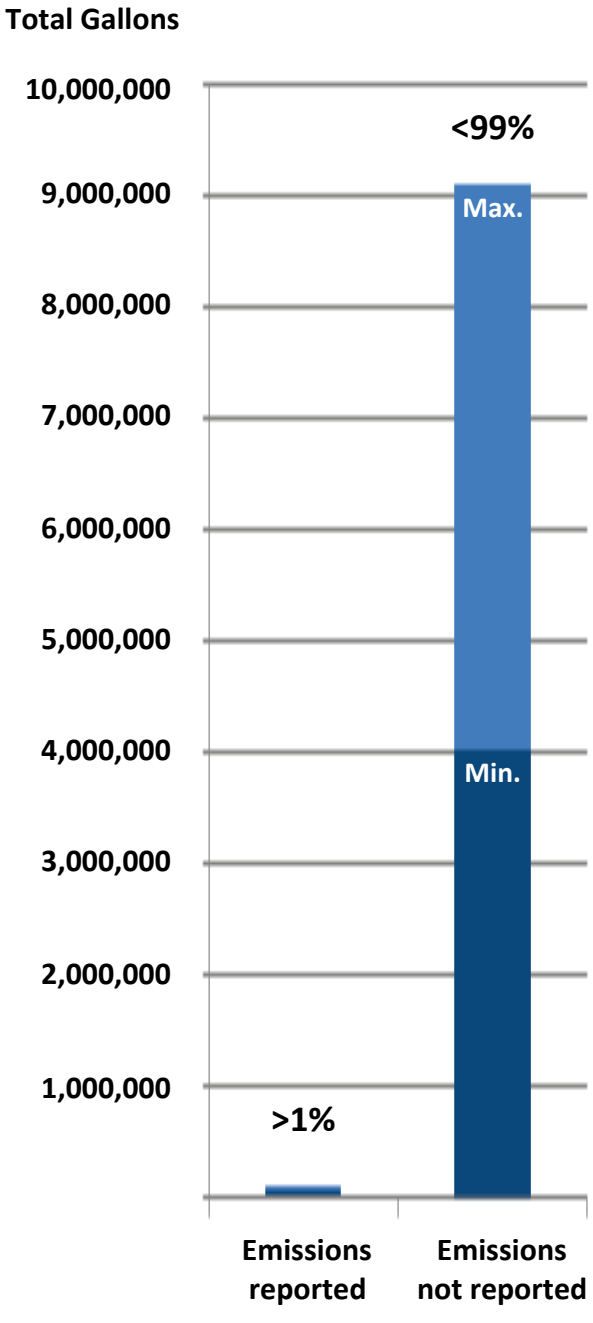
ACDP HSIS Study

Comparison of Toxic Chemicals Use by Permit Type In Multnomah and Washington Counties, Oregon

By Doug Loqa, Robert Mannering, Seth Woolley, Greg Bourget





The Oregon Fire Marshall's Hazardous Substance Information System (HSIS) reports the hazardous chemicals stored on site of all Oregon industries. HSIS reports almost all volumes in either pounds or gallons. Oregon Department of Environmental Quality (DEQ) requires the largest polluting industries to have Title V permits, and report most smokestack emissions. The smaller bar on the left of each graph reports the sum of hazardous chemicals on site at Title V industries.

The taller blue bar on the right of each graph reports toxics chemicals on site of industries who DEQ requires either a Standard, Simple, General, or Basic Air Contaminant Discharge Permits (ACDP). The hazardous air pollution emitted by these non-Title V industries with an ACDP are not reported by any agency. These non-Title V industries use approximately 95% of hazardous chemicals stored by industry with ACDPs in the Portland area.

For this study we included chemicals that comprise hazardous industrial air pollution. We excluded chemicals that HSIS includes due to fire danger and other hazards that primarily concern firefighters. The excluded HSIS Hazard Classes listed in red are excluded by the Fire Marshall from public disclosure due to the threat of terrorism.

HSIS Hazard Classes included in this study

6.1 Poisonous Defined by the amount that is a lethal dose.

examples:

ARSENIC
CADMIUM
CHROMIC ACID
COPPER CYANIDE
COPPER CYANIDE
HYDROFLUORIC ACID
HYDROGEN FLUORIDE
ISOCYANATES
PHENOL
POTASSIUM CYANIDE
ZINC CYANIDE

6.3 Acute Health Hazards

Defined by immediate adverse health effect from exposure

examples:

ASPHALTS (PETROLEUM)
COPPER
DIBUTYL PHTHALATE
FORMALDEHYDE
LEAD
MERCURY
MONOBUTYL ETHER
NAPHTHAS
NICKEL
PERCHLOROETHYLENE
PETROLEUM DISTILLATES
SODIUM HYPOCHLORITE
STYRENE

6.4 Chronic Health Hazards

Defined by adverse health effect from long term exposure

examples:

ASPHALT
BISPHENOL A
CHROMIUM
COPPER
FORMALDEHYDE
LEAD
MANGANESE
MERCURY
NAPTHALENE
NICKEL

HSIS Hazard Classes excluded from this study

1.1 CLASS A EXPLOSIVES
1.2 CLASS B EXPLOSIVES
1.3 CLASS C EXPLOSIVES
1.4 BLASTING AGENTS
1.5 INSENTITIVE EXPLOSIVES
1.6 EXTREMELY INSENSITIVE DETONATING SUBSTANCES
2.1 FLAMMABLE GASES
2.2 NONFLAMMABLE GASES
2.3 POISON GASES
3.0 FLAMMABLE AND COMBUSTIBLE LIQUID
4.1 FLAMMABLE SOLIDS
4.2 SPONTANEOUSLY COMBUSTIBLE MATERIAL
4.3 DANGEROUS WHEN WET
4.4 REACTIVE MATERIAL
4.5 COMBUSTIBLE MATERIALS
5.1 OXIDIZERS
5.2 ORGANIC PEROXIDES
6.2 ETIOLOGIC MATERIALS
6.5 PESTICIDE
7.0 RADIOACTIVE MATERIALS
8.0 CORROSIVES
9.0 MISC.HAZ. MATERIALS

For a complete list of chemicals we removed from Haz Class 6.1, 6.3, and 6.4 for this study, see page 6 of this report.

Where do hazardous chemicals go when they leave the industry?

Stored Hazardous chemicals

Used by Industry

Released to the air

Wastewater sent to treatment center, stream, or river

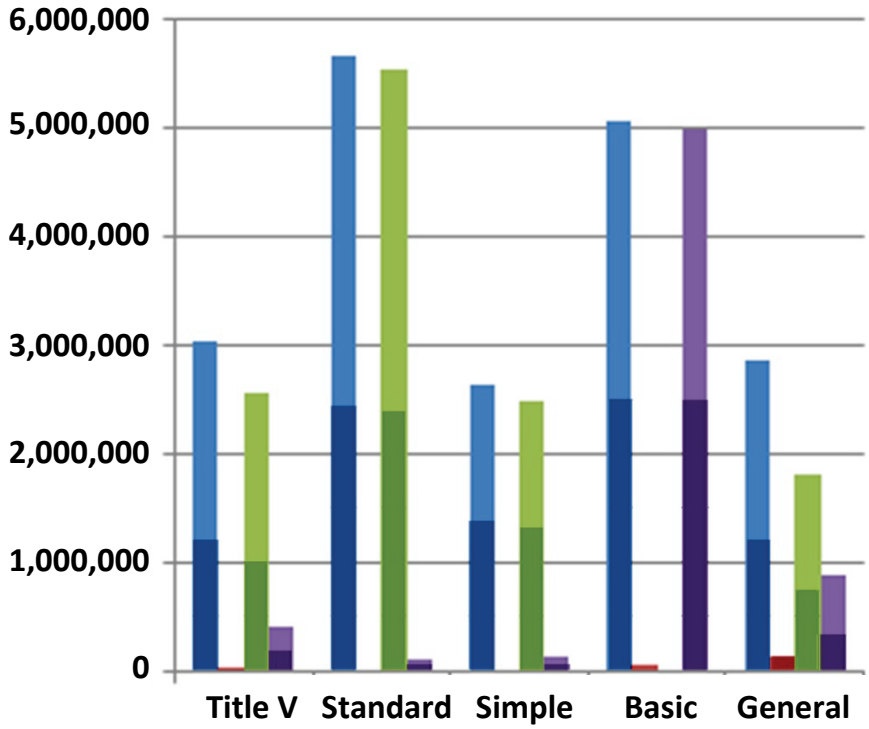
Solid/ hazardous waste sent to recycling, incinerated/pyrolysis, hazardous waste landfill, or made into cement

Made into a product

The sum of HSIS listings by ACDP

In Multnomah and Washington Counties

Pounds



These graphs show that polluting industries with ACDPs that are not Title V, those that are not required to report emissions, use the majority of hazardous chemicals in each HSIS hazard class.

Maximum total
Minimum total

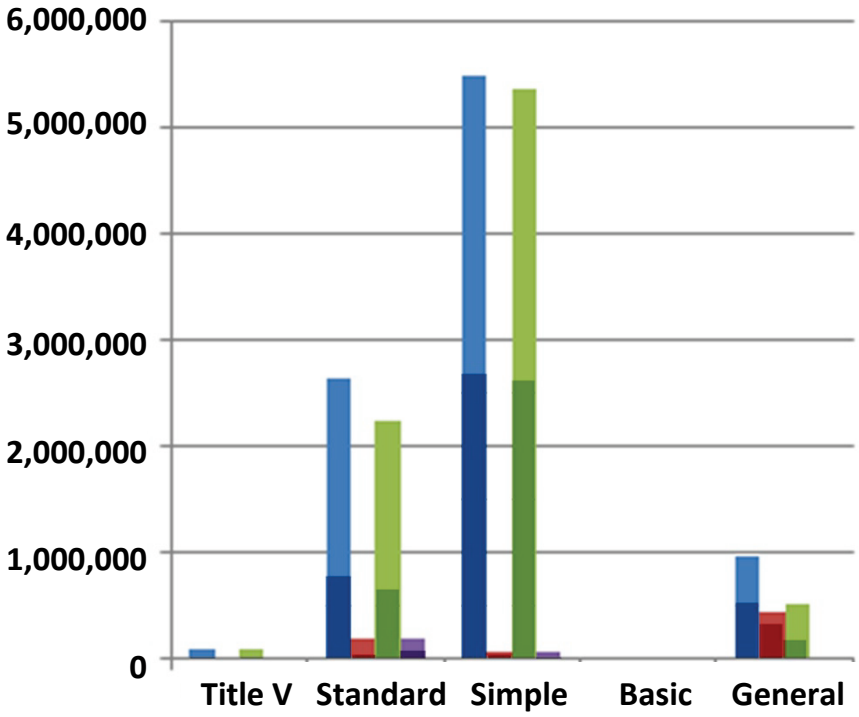
Maximum total 6.1 Poisonous
Minimum total 6.1 Poisonous

Maximum total 6.3 Acute HH
Minimum total 6.3 Acute HH

Maximum total 6.4 Chronic HH
Minimum total 6.4 Chronic HH

HH = Health Hazard

Gallons



HSIS Listings include both pounds and gallons. A few minor HSIS listings are in cubic feet which we omitted. For these graphs we didn't convert so both are shown here separately.

Maximum total
Minimum total

Maximum total 6.1 Poisonous
Minimum total 6.1 Poisonous

Maximum total 6.3 Acute HH
Minimum total 6.3 Acute HH

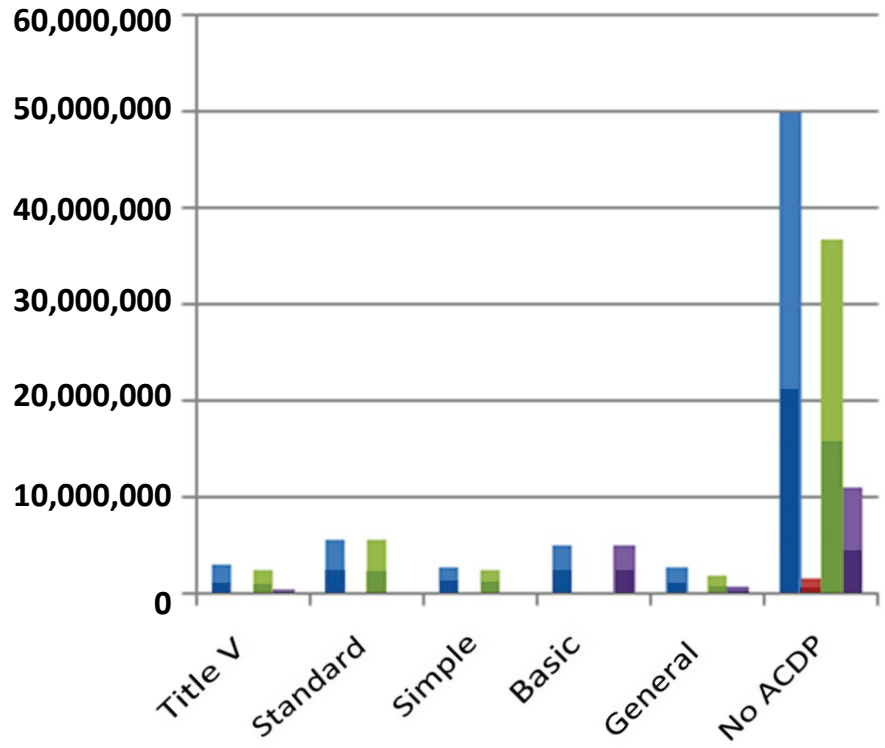
Maximum total 6.4 Chronic HH
Minimum total 6.4 Chronic HH

HH = Health Hazard

Comparing HSIS with/without an ACDP

In Multnomah and Washington Counties

Pounds



Presumably most industries without an ACDP do not pollute the air. However, they store the majority of onsite hazardous chemicals. Some are air polluters; Uroboros Glass was a major Portland air polluter without an ACDP from 1973 - 2016.

Maximum total
Minimum total

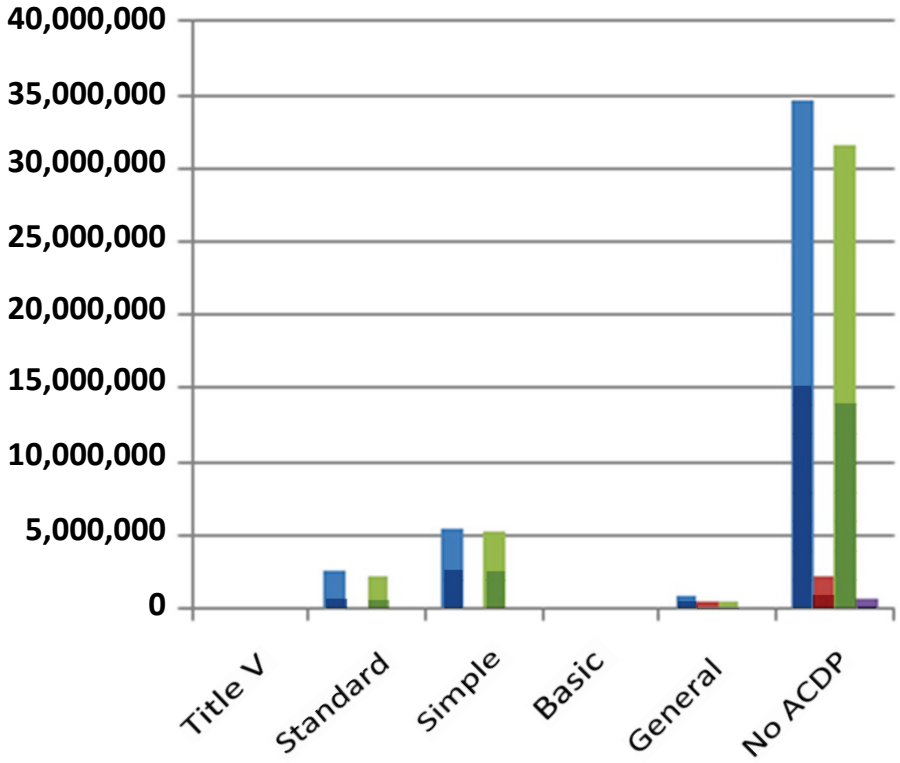
Maximum total 6.1 Poisonous
Minimum total 6.1 Poisonous

Maximum total 6.3 Acute HH
Minimum total 6.3 Acute HH

Maximum total 6.4 Chronic HH
Minimum total 6.4 Chronic HH

HH = Health Hazard

Gallons



Industries without an ACDP are barely regulated. Even if all industries without ACDPs weren't air polluters, storage of dangerous chemicals can lead to accidents and so still require better reporting and oversight.

Maximum total
Minimum total

Maximum total 6.1 Poisonous
Minimum total 6.1 Poisonous

Maximum total 6.3 Acute HH
Minimum total 6.3 Acute HH

Maximum total 6.4 Chronic HH
Minimum total 6.4 Chronic HH

HH = Health Hazard

What percentage of chemical usage is by Title V industries?

HSIS chemical listings are in either pounds, gallons, or cubic feet. The only HSIS listings in cubic feet, which we omitted, include a total of 500-999 cubic feet of chemicals on site at some industries with Standard ACDPs and a total of 16,000 - 43,990 cubic feet of chemicals on site at industries without ACDPs.

TOTAL POUNDS Multnomah County HSIS:

Minimum:

1,203,000	7,561,796	15.9%
Title V	All other Permit types	% Title V

Maximum:

3,034,987	16,241,415	18.7%
Title V	All other Permit types	% Title V

TOTAL GALLONS Multnomah County HSIS:

Minimum:

26,000	4,009,304	.6%
Title V	All other Permit types	% Title V

Maximum:

93,989	9,103,862	1%
Title V	All other Permit types	% Title V

We converted gallons to pounds to report the percentage of chemicals on site at Title V industries.

CONVERT GALLONS TO POUNDS:

1 gallon water = 8.36 pounds
1 gallon soap powder = 8 pounds

Gallons x 8:

Minimum gallons converted to Approximate pounds:

208,000	32,074,432
Title V	All other ACDP types

Maximum gallons converted to Approximate pounds:

751,912	72,830,896
Title V	All other ACDP types

Pounds + (Gallons converted to pounds):

Minimum:

1,411,000	39,636,228	3.6%
Title V	All other Permit types	% Title V

Maximum:

3,786,899	89,072,311	4.3%
Title V	All other Permit types	% Title V

Answer:
>5% of hazardous chemical usage in Multnomah and Washington County is by Title V industries

How many 55 gallon drums is that?

Divide totals by 8:

Minimum:

176,375	4,954,528
Title V	All other Permit types

Maximum:

473,362	11,134,038
Title V	All other Permit types

Answer:
Title V industries in Multnomah County have 176,375 - 473,362 55 gallon drums of hazardous chemicals on site.

All other ACDP types have a total of 4,954,528 - 11,134,038 55 gallon drums of hazardous chemicals on site.

Portland Clean Air

HSIS comparison by ACDP by Loqa, Mannering, Bourget, and Woolley

Why is this study important?

This study demonstrates that up to 95% of hazardous chemical usage in Multnomah and Washington Counties is by industries that do not report hazardous air pollution. Less than 5% of hazardous chemicals stored on site in Portland are used by industries subjected to the enhanced reporting required of Title V industries. Industries require Title V permits only when they have the potential to emit "10 tons of any single hazardous air pollutant or 25 tons of any combination of hazardous air pollutants."

In Multnomah and Washington County, the extent of this study, only 20 out of 443 industries with an ACDP have a Title V Permits. These totals exclude all gas stations which require a General ACDP.

For Title V industries, a citizen can go online and know what is being emitted. For example the ESCO steel mill Title V Review is online at http://www.deq.state.or.us/aq/permit/tv/nwr/262068esco_rr.pdf
On page 24 the DEQ reports the following estimated annual releases from the plant - here is an excerpt from 37 hazardous air pollutants released annually by Esco smokestacks:
Lead 207 pounds
Nickel 191.3 pounds
Chromium 132.7 pounds
Cadmium 56.6 pounds

For Bullseye Glass, which has not had a Title V Permit, their DEQ Permit Review reported a total of 6,000 pounds a year of arsenic trioxide, cadmium, selenium, chromium, and lead being used annually - incinerated in their unfiltered furnace. This ACDP Review reporting was only to note these combined Hazardous Air Pollutants would be under 50,000 pounds annually and so would not trigger a requirement for a Title V permit.

Esco's releases, along with all other Title V industries, are compiled by the DEQ Technical Services Division. This Division, required by the Clean Air Act, provides data to the Environmental Protection Agency National Emissions Inventory. Portland Clean Air asked a Director at DEQ's Technical Services Division if they knew an estimate of how much lead, chromium, mercury, cadmium, or other hazardous chemicals were released by industry in Oregon. They replied that they did not. Oregon DEQ has no inventory, no spreadsheet, or other compiled data, other than for Title V industries. Yet Title V industries use less than 5% of hazardous chemicals as demonstrated in this study.

This study did not access individual chemicals. For example HSIS in Multnomah and Washington Counties lists more than 20 companies using lead. For 42 years, Bullseye Glass was putting 100 pounds of lead a day into its unfiltered furnace when making white glass. 85% of that lead was volatilized up their stacks and went airborne into the surrounding neighborhoods.

It is the DEQ's job to know how much lead or mercury, or other dangerous chemicals are going into the air. HSIS only collects chemical storage data. Data on how chemicals are used, and how much are used, has been collected in the ACDP Reviews but the DEQ never typed that information into a spreadsheet. A knowledge of industrial processes is required to know how much of the chemicals used go airborne, and how much ends up in the product, or another waste stream.

It would not cost much for the DEQ to compile the results of their onsite investigations reported in ACDP Review. Many industries already know what percentage of the chemicals they use go airborne. Bullseye knew.

This lack of interest from the DEQ in chemicals emissions from factories has caused Multnomah County serious problems. The latest EPA National Air Toxics Assessment released December of 2015 found Portland was the worst American city for respiratory distress from air pollution. Exposure to hazardous industrial chemicals causes asthma, organ damage, birth defects, and cancer.

How complete is HSIS data?

The Oregon Office of State Fire Marshall's HSIS has three auditors making random inspections of facilities, and they have a hotline for industry to help them report correctly. HSIS has a chemical specialist available for industry. There are penalties for noncompliance.

Fire Marshalls have an interest to know what chemicals are onsite for the safety of fire fighters. Fire Marshalls are aware of compliance and report new businesses to HSIS.

New businesses must obtain licenses at Oregon License Directory operated by the Secretary of State at:
http://sos.oregon.gov/business/Pages/check-state-license-requirements.aspx
This system reports back to HSIS so they can send inventory forms of onsite chemical storage.

In many ways, HSIS data appears to be far more complete than Department of Environmental Quality Air Contaminant Discharge Permit data.

There are 12,515 facilities in HSIS statewide.
In Multnomah and Washington County there are 2,955 HSIS facilities.

For this study we removed the following chemical names from our geographical search:
gas, diesel, batteries, battery, or propane, hydrogen - helium mix, oxygen, nitrogen, nitrous oxide, argon, methane, helium, carbon dioxide, acetylene, hydrous sand and kaolin clay, starch, sucrose, vinegar, petroleum, silica sand, inorganic salt, ethylene glocol, titanium dioxide, DEET, oil based paint, paint, ferrous sulfate, calcium sulfate, salt, sand, concrete, lead acid batteries, nitrogen, oxygen, helium, perlite, sodium chloride, talc, used oil, various inert gasses, sodium carbonate, silica sand, automatic transmission fluid, antifreeze, cat litter

If these were the only substances on site then we removed the industry entirely. This left 1025 facilities in Washington and Multnomah Counties.

Multnomah County has 285 facilities with ACDPs excluding gas stations. Washington County has 158 facilities with ACDPs excluding gas stations. Total ACDPs in Washington and Multnomah Counties is 443 excluding gas stations. Some air polluting industries do not have an ACDP at all. Uroboros Glass in Portland, in the news for significant emissions of cadmium, has never been required to obtain an ACDP. New rule making in 2016 required Uroboros to obtain an ACDP for the first time. Uroboros has always had an HSIS listing.

Chemical storage not included in PCA's version of HSIS data

Some HSIS data is removed as confidential. PCA did not include any confidential data. There are two reasons a chemical is listed as confidential:

Trade secrets:
If an industry is allowed to protect chemical storage from being public information because this would jeopardize an industrial trade secret, then the chemical is listed instead as:
"tradesecret haz class" and a number such as 6.3
So for example, if an industry does not list hexane because doing so would reveal a trade secret, then the Fire Marshall would see it listed as hexane because the Fire Marshall has a copy of the confidential HSIS. The public would see the chemical listed as "tradesecret haz class" and a number

National Security:
After 911 the law changed and HSIS chemicals were made confidential if the chemicals are:
explosives, poison gasses (weapons of war like chlorine gas), etiologics (infectious agents), and radioactive materials.

Response from the DEQ

Portland Clean Air sent a draft of this report to numerous government agencies, elected officials, air pollution groups, and neighborhood groups for review and comment. Oregon Department of Environmental Quality (DEQ) responded with a page of comments. What follows is DEQ's response to this report:

See the third paragraph on the right column of page 7 states, "A knowledge of industrial processes is required to know how much of the chemicals used go airborne, and how much ends up in the product, or another waste stream." DEQ agrees with this statement.

"In the third paragraph of the right column in page 7, you state that the ACDP Reviews contain data on chemical usage. If by "Reviews", you are referencing the ACDP Review Reports, DEQ would agree that some, but not all, ACDP review reports contain chemical usage information. In the next paragraph (fourth paragraph of the right column on page 7), it appears that you may be referencing a DEQ inspection report as a "Review". DEQ inspection reports may also have chemical usage information, but that depends on whether an air quality permit requires this information to be maintained as a record that DEQ would review. Similar to the amounts of chemicals reported to HSIS, the amount of chemical reported in an ACDP Review Report or DEQ inspection report are usage rates and knowledge of the industrial process is required to determine how much of a given chemical would leave a facility as an air emission.

Relating to the paragraph top right column of page 7, DEQ agrees that it doesn't have a facility by facility estimate or calculation of industrial air toxic emissions; this is what the regulatory overhaul of the state's air permitting program, "Cleaner Air Oregon", will allow us to complete.

DEQ develops a statewide emissions inventory every three years. The effort is a partnership between DEQ and EPA. For the statewide emissions inventory, DEQ estimates small ACDP source emissions as an "area source", with resulting concentrations at the county-wide level. A good example of this are emission estimates for industrial natural gas boilers. First, DEQ identifies the total amount of natural gas fuel used in the industrial sector (this information is reported to the Federal Energy Information Administration) and then breaks down the total by county. The reported and known amounts of natural gas used by Title V sources is then subtracted from the total amount of natural gas used in that county. Then, DEQ applies emission factors (such as AP-42, Chapter 1.4 – Natural Gas Combustion, which can be found: https://www.epa.gov/air-emissions-factors-and-quantification/ap-42-compilation-air-emission-factors) in combination with the amount of natural gas used, to estimate the total amount of hazardous air pollutants for that county. This is repeated for each county in Oregon. The results of these efforts are available at the US EPA's National Emissions Inventory website, here: https://www.epa.gov/air-emissions-inventories/national-emissions-inventory-nei.

Overall, DEQ agrees that the current air quality regulatory structure has not adequately addressed air toxics, which is why DEQ is proceeding with the Cleaner Air Oregon rulemaking. DEQ encourages you to continue your engagement in the Cleaner Air Oregon rulemaking process."

Michael R. Orman, E.I.T.
Air Quality Section Manager,
Northwest Region
Oregon Department of Environmental Quality
700 NE Multnomah St., Suite 600
Portland, OR 97232

Methodology

How PCA got the HSIS and ACDP data

By Greg Bourget, Lead Researcher,
Portland Clean Air

HSIS

A. For HSIS data I first went to:
http://www.sfm.state.or.us/CR2K_SubDB/SubstanceSearch.htm
A sign in name and password is required first and can be obtained through the site.
There is no way to do a geographic search nor to export the complete dataset.

B. I called the number on the page (503) 934-8353, this connected me to:
Shelly Kendrick, Information Assistant
Community Right to Know Program
Oregon Office of State Fire Marshal
Oregon State Police

C. She sent me a the CR2K Information Request form:
http://www.oregon.gov/osp/SFM/docs/CR2K/CR2KInfoRequestForm.pdf

D. In response to sending in the completed form Shelly sent me a password to access:
http://www.oregon.gov/osp/SFM/pages/cr2k_infoavailable.aspx

E. There I downloaded HSIS software which requires a full version of Access 2010 or later. It comes with Access 2010 Runtime but that is not sufficient to export data.

F. I downloaded a free trial of Access 2016 at:
https://products.office.com/en-us/try

G. The software didn't work so I called Shelly, she explained:

1. Create a file called HSIS at the root to the C drive
2. Place all downloaded files from the HSIS database in the HSIS folder on C
3. Open HSISPublic.accdb
4. Go to "Searches and Reports"
5. Go to "Export"
6. Under "Table to Export" Choose tblHSISFacility
7. Under "Path and File" choose HSISExport.accdb which is in the HSIS folder at the root of C
8. Press the "Export" button
9. Do steps 6-8 again but this time choose tblHSISFacilityChems
10. Open HSISExport.accdb

H. This created an Access database with two tables. One has facility information and the other has chemical storage information.

I. Seth then wrote scripts that combined the data into one table using the FacilityID column which both tables share in common.
This produced the tab delineated dataset which you can download at:
http://portlandcleanair.org/files/merge/
The file is called joined.tab
This file can easily be imported into any spreadsheet program such as Microsoft Excel

J. I removed all counties other than Multnomah to create Mult joined HSIS.xls

ACDPs

First, it took six months of occasional phone calls to DEQ to answer the question: "How do I find out which industries you regulate and what chemicals these industries emit into the air?" DEQ workers kept referring me the DEQ Facility Profiler. This online database has little benefit to the public and cannot be used to answer the question above.

Once we realized we wanted Air Contaminant Discharge Permit (ACDP) information, this led to another six months of phone calls and an in-person meeting with DEQ officials. At that meeting Portland Clean Air announced the intention to sue the DEQ to obtain access to ACDP records. The DEQ then dropped the thousands of dollars of requested access fees, and wheeled about 8,000 pages of paper records into their reading room of which we scanned over 5,000 pages and put online for the first time. At that time DEQ emailed us a spreadsheet of ACDPs for Multnomah, Washington, and Clackamas Counties. These spreadsheets were

used for this report. Portland Clean Air and EPAC volunteers spent a total of 40 hours in the reading room scanning all Air Contaminant Discharge Permits (ACDP). Now citizens can go to our geographical search at portlandcleanair.org and download PDFs of these documents for free.

The steps that the DEQ requires the public to complete to get a copy of an ACDP:

1. Research the DEQ public records request process.
2. Research the industry(s) near the citizen's home or workplace (Other than using portlandcleanair.org this is almost impossible - see below **)
3. Fill out an online public records request form that appears not to work (for our information requests I had to email in a screen shot as the "send" button did not work.)
4. Wait for response
5. Pay a fee or fill out a fee waiver request form
6. Wait for delivery
7. Repeat steps 3 - 6 for each industry near the citizen's home of workplace.

Now a citizen can go to portlandcleanair.org and look at a map and download ACDPs without wasting DEQ resources, fees, or their own time wasted. Step two above took me six months working 1-2 hours per week, after eight phone calls to DEQ staff asking how to find out who were the industrial air polluters by my house. My GPA was 3.84 in Political Science from HSU. I also had the help of Seth Woolley who is a senior programmer and spatial database expert.

** Using the DEQ Facility Profiler at http://deq12.deq.state.or.us/fp20/ to research the industries near a person's house requires:

1. Find the DEQ Facility Profile by calling DEQ and talking to staff.
2. Make a geographic request.
3. Export the giant list that results.
4. Research the numerous categories in the resulting list.
5. Isolate TRAACS data.
6. Plot the TRACCS data using Google maps.
7. Make a list of industries by your home or workplace possibly causing a smell or nuisance.
8. Research the ACDP permit type for each industry.

Combining the two HSIS tables provided by the Fire Marshall

By Seth Woolley, Data Specialist,
Portland Clean Air

The two tables were facility and materials. I did a table join called an inner table join. I used SQLite. Using standard imports I joined using facility ID which was the same on both tables.

Combining HSIS and ACDP data

By Robert Mannering, GIS Director,
Portland Clean Air

A key focus of Portland Clean Air's mapping of hazardous air pollution across the city was correlating onsite chemical storage data with each industry's Air Contaminant Discharge Permit (ACDP). Chemical storage data was not included with the ACDPs, ACDP Reviews, ACDP Applications, or Annual Reports obtained from DEQ. We requested and received a separate data set from the Portland Fire Marshal's office that itemized inventoried chemicals at industrial facilities across the state (HSIS).

By combining the two datasets (ACDP and HSIS listings) we were able to better understand the chemistry of the industrial processes at known air polluting facilities across Portland. Below is the outline for the method used to marry the data sets.

1. **Examination of raw data**

In both cases, ACDP and HSIS data arrived to us in Excel format.

ACDP data was presented in a one-to-one relationship. That is, for each company in DEQs database, one permit was issued. The row for each permit listed, among other things, the facility name, address and class of permit (basic, simple, standard, title v). There was also a field labeled 'source

number' that was a unique identifier for each facility within the database. Crucially, from the perspective of Portland Clean Air, there was no listing for specific chemical presences within the permit type.

HSIS data was presented in a many-to-many relationship. That is, for multiple facilities in the HSIS data, multiple entries existed for known stored chemicals on site. Data records listed the chemical compound as well as the maximum anticipated amount that was in storage.

2. **Conjoining both data sets**

For this study, I needed to isolate the 443 facilities in Multnomah and Washington Counties that had been issued ACDPs from DEQ within the HSIS data from the Fire Marshal's Office and determine the multiple HSIS records related to each unique ACDP permit listing. Using the VLOOKUP function within excel, I built an automated system that would, for each hazardous material listing, scan the address field in the HSIS listings and compare it to the range of addresses in the ACDP data. If there was an address match, the 'source number' field from the ACDP information was tied on to the relative stored chemical listing in the HSIS data. Thus, the source number field was established as a key to link the two spreadsheets in a one-to-many relationship: for each ACDP permit record, multiple HSIS chemical storage listings were attributed.

3. **Mapping the results**

Using the RLIS geocoding service provided by Portland Metro, all ACDP entries were uploaded to a point shapefile within ArcMap based on their listed street address. The RLIS Address Locator plotted a 6 figure coordinate associated to each address within the data. With assigned x and y coordinate data, a map of all ACDP permits was displayed in ArcMap.

Within ArcMap, a tool exists for relating different data sets to each other. 'Relating Tables' in Arc is a process that conjoins two separate data sets using a common key. In this case, as was described, a common key was created in Excel based on the 'source number field'. Using the source number field, both sets of data were related to each other and saved to a new shapefile featureset.

As a result of the related join, it is possible within Arc to click on an ACDP feature and examine a drop down menu that displays all of the HSIS records associated with the source number of that ACDP feature.

Using ArcMap's table to Excel feature, I was then able to create a populated list of all known HSIS chemicals at each ACDP site and distribute it along with maps displaying ACDP locations as well as HSIS entries that were stored at facilities that had no permit for air contaminant discharge.

Statistical analysis of HSIS data by ACDP

by Doug Loqa

I was provided the PCA edited HSIS dataset for Multnomah and Washington Counties that were geotagged and matched to geotagged ACDPs. ACDPs were labeled 1 to 6. "N/A" in the ACPD fields was used when no ACDP was assigned to the industry. Each record had weight or volume information for the chemicals stored by the facility in either pounds, gallons, or cubic feet. The facilities also were broken down into categories whether a field had one of 4 Hazard class types (6.1, 6.3, 6.4, 6.5). I developed a table for comparison of the different facilities.

Spreadsheet Procedures

1. I copied the following fields into a separate spreadsheet: FacilityID, FacilityName, TRIFacility, County, ChemName, MaxAmt, UnitMeas, UnitDesc, HazClass1, ACDP Permit Class

2. "N/A" fields were considered the same as the "6" category. On a spreadsheet, I created 3 new fields to help with the analysis: Low End(MaxAmt), High End(MaxAmt), and a second ACDP Permit class with formulas that extracted the lower value and the higher value from "MaxAmt" above, and copied all information from ACDP Permit Class over with

a conversion condition changing all "N/A" s to "6".

Note: there was one problem with the LowEnd and HighEnd(MaxAmt) fields that was discovered later. Some fields didn't have a range (IE. ####-####). This caused an error in those fields of "#Value". All of those records had a MaxAmt value of either 42499 or 42662. These had to be converted later and caused some minor errors as there were only a couple of these that had this issue.

3. I then copied the following fields into a separate sheet with all of their cold data (formulas removed): FacilityID, FacilityName, TRIFacility, County, ChemName, Low End(MaxAmt), High End(MaxAmt), UnitDesc, HazClass1, ACDPPermitClass(new).

   I then converted these into a .csv file, and exported this record set into R statistical application software. This software has some advanced statistical functionality and advanced graphing capabilities. The rest of this work could be done in Excel. There is a small pivot table in the workbook that was created based on this information for quality assurance. The analysis looked at the total values.

4. In R, I created 3 data sets by filtering the mass set into whether toxins were measured by pounds, gallons, or cubic feet.

5. The data sets (I called them CatP, CatG, and CatCF) were then measured for their total mean and average based on 6 categories which were evaluated based upon the ACDPPermitClass mentioned above. Each data set was built based upon assigning a title to each of the numbers in the ACDPPermitClass field mentioned above. I used the following values : 1= Title V, 2= Standard, 3=Simple, 4=Basic, 5=General, 6=No ACDP).

6. I then set up some looping algorithms in R that looked through each value (1-6) and filtered the ACDPPermitClass to each individual number for each calculation I wanted to make. I looked for the low and the high values of each field. At this point I converted the "#Value" errors in order to make the calculations work. R had some methodology to convert these to "N/A" first, and then I could select all of the "N/A" values and convert them to a number. In some of the fields, when I filtered to "N/A" values, the only number in the spreadsheet was 42662, which most of these were.

   The error came into play, when in a couple fields down the line, I noticed that a couple of the records were 42499. I tried to go back, find the facilities that had those, and change those to 42499. It was a little tricky, and I think only 1 or 2 records still were at the 42662 value. The discrepancies found in quality assurance were either a 1 or 2 multiple of the difference between these two numbers (163). The discrepancies occurred when I compared the output totals from these processes to the pivot table totals. This was the only discrepancy. The low and high values were the same value for both of these.

7. After conducting basic Mean and Total calculations, I created a few functions to run calculations based upon the HazClass category of a toxin. I created a small set of comparison values to run through (6.1, 6.3, 6.4, 6.5) and then ran a double loop through this set and the ACDP values (1-6). Each HazClass value was matched against an ACDP value. The calculations that were set up via these functions were the totals, means, and now the percentage breakdown of each ACDP class for each HazClass type. These were also broken into data sets for low and high range values.

8. After I created these functions/ formulas for each type of measure (pounds, gallons, etc), I exported these finished data sets into an Excel format. I combined the three into one workbook with different sheets for each. Then, I imported that new spreadsheet into the original one, where I created the pivot table, the cold data set, and the initial formulization. This is called "Six Category Summary data".

9. Finally, I ran comparisons as mentioned above, between a pivot table that categorized the columns into low and high range values with row categories of Hazard class number and ADCP class number. You can see totals using the tabs at the bottom of the spreadsheet called Six Category Summary Data.xlsx. I compared those totals to the totals achieved in the R analysis, and found only minor errors. These errors are mentioned above for the ACDP classes (5/General, and 6/No ACDP). I colored those errors light green.

   I formatted the three sheets to clarify the distinction between Mean, Average, and Percentage breakdowns of this cross-referencing. In the final report, I have a workbook with a hidden (Formulated sheet), and five other data sheets (Cold Data, Pivot Sums, Pounds, Gallons, and Cubic Feet). For the hidden sheet, if you right-click in the tabs at the bottom, you can see an area that says "Unhide." The first data sheet is the cold data that was imported into R, the second is the pivot table based on the cold data. The last three data sheets are reports based upon my statistical analysis.

   The dataset Six Category Summary Data.xlsx can be downloaded at:

   http://portlandcleanair.org/files/Six%20Category%20Summary%20Data.xlsx

Works Cited:

Environmental Protection Agency. 2015. 2011 National Air Toxics Assessment. Found online at: www.epa.gov/national-air-toxics-assessment

Oregon Department of Environmental Quality. 2015. Air Contaminant Discharge Permit Spreadsheet for Multnomah and Washington Counties. Received by numerous public information requests and agreement with DEQ preceding PCA lawsuit against DEQ for access.

and 2016. Email response from Michael Orman, Air Quality Section Manager, Northwest Region, DEQ commenting on this report. Obtained from email from DEQ and used in this report by permission.

Office of State Fire Marshall. 2016. Hazardous Substance Information System. From database received via password, combined, and placed online at: http://portlandcleanair.org/2016-04-20-SFM-HSIS-EPA-NEI-data.html

and 2016. CR2K Information Access. Found online at: https://www.oregon.gov/osp/SFM/pages/cr2k_infoavailable.aspx

and 2016. Community Right to Know. Found online at: http://www.oregon.gov/OSP/SFM/Pages/CR2K_Home.aspx