

HARP POINT SOURCE SAMPLE PROBLEM

Objective: This is a sample problem for the HARP software. It was designed to test your ability to enter a simple facility into HARP for the goal of completing a health risk assessment (HRA). To complete this sample problem, you need to be familiar with the risk assessment methods presented in the OEHHA Risk Assessment Guidelines. This sample problem will take you from beginning (data entry) to end (risk results) of a facility HRA. To check your results, **the answers are included at the end of the sample problem.**

Facility: The sample is for a business in San Diego County.

Gilda's Gadgets
4232 Spinning Top Lane
Clockwork, CA 92037
San Diego APCD

Contact Name: Gilda Gilman



A. Set-up Your Project:

1. Create a new folder under the C:\HARP directory called "gadgets".
2. Open HARP and begin your project by following the 4 steps outlined in How-To Guide, Topic 1.

B. Enter the Facility Data:

1. Add new facility to the database year 4242
 - a. Facility ID number: 2555
 - b. Facility SIC: 4911
 - c. Facility Location: East: 475.111 km
North: 3633.333 km
Datum: NAD83
Coordinate System: Zone 11
2. Gilda's Gadgets has one stack
 - a. **Release/Stack 1:** Name: smoke stack
 - i. Point Source
 - ii. Release Height: 59 feet (18 m)
 - iii. Stack Diameter: 1.5 feet (0.46 m)
 - iv. Temp: 300 K (80 F)
 - v. Velocity: 3520 fpm (18 m/s) (40 mph)

b. Release/Stack 1 Location:

- i. East: 475.11815 km
- ii. North 3633.34134 km
- iii. Datum: NAD83

3. Gilda's Gadgets has one device

- a. **Device 1:** Furnace
- b. Permit number: 2051

4. Gilda's Gadgets has two processes

- a. **Process 1, Device 1:**
 - i. SIC: inorganic pigments
 - ii. SCC: 30103599

b. Emissions for Process 1, Device 1:

CAS	Pollutant	Annual Emiss (lb/yr)	Max Hrly (lb/hr)
7440-38-2	Arsenic compounds	0.7	0.001
1746-01-6	2,3,7,8-Tetrachlorodibenzo- <i>p</i> -dioxin	4.0E-4	0
66-66-6	Whirligig Coloring Powder	0.5	0.002

c. Process 2, Device 1:

- i. SIC: unknown
- ii. SCC: unknown

d. Emissions for Process 2, Device 1:

CAS	Pollutant	Annual Emiss (lb/yr)	Max Hrly (lb/hr)
50-00-0	Formaldehyde	200	30

e. Add the building and property geometries

- i. **Building 1, Tier 1**
- ii. **Building Height:** 15 meters
- iii. **Building Boundaries:**

Plot order	East	North
1	0	0
2	20	0

(continued next page)

3	25	10
4	20	25
5	10	30
6	0	15

iv. **Property Boundaries:**

<u>Plot order</u>	<u>East</u>	<u>North</u>
1	-30	-30
2	30	-30
3	30	30
4	0	30
5	-30	0

C. Air Dispersion Analysis:

Now we want to analyze the air emissions from Gilda's Gadget factory and see if any of the neighbors are being impacted by the whirligig powder. **NOTE:** There are no representative meteorological data sets for the town of Clockwork.



1. Setting up the Dispersion run
 - a. Open the Dispersion Analysis Module.
 - b. Fill-in the information in the "ISC Files" Tab. (reminder- title entries can have spaces; but, file name(s) should not.)
 - c. Make sure that you **rename** the "ISC Input File Name".
 - d. **Choose File/Save As** and rename the Dispersion Workbook. The name of the workbook should match the name of the ISC Input file.

2. Sources Tab:
 - a. Enter the source and generate the source identifications.

3. Control Tab
 - a. Terrain: flat
 - b. Keep Regulatory defaults

4. Grid Receptors:
 - a. Grid size: East: -2000 x 2000; North: -2000 x 2000; Use 100 meter spacing.
 - b. Flagpole height: 1.2

5. Property Boundary Receptors:
 - a. Spacing: 20 m
 - b. Flagpole height: 1.2

6. Sensitive Receptors:
 - a. Use selection filter to find all receptors within 2000 meters of facility.
 - b. Flagpole height: 1.2

7. Census Receptors:

- a. Use selection filter to find all receptors within 2000 meters of facility.
- b. Flagpole height: 1.2

8. Pathway receptors:

- a. Flagpole height: 0
- b. Coordinates:

	<u>UTM East</u>	<u>UTM North</u>
Water	474700	3633000
Pasture	474750	3632950
Fish	474800	3633050

Question: Do you want to save the hourly X/Q data? Why or why not?

D. Risk Analysis Exercises:

Now that we have determined where Gilda's Gadgets whirligig powder is falling, it is time to determine who is at risk of spinning like a top.



Reminders/Settings and Initial Assumptions:

- a. Using the Step-Through, load in your Source-Receptor file.
- b. Set your site parameters to the mandatory exposure pathways (e.g. Soil, dermal, etc).
- c. Gilda's Gadget factory has no emission control equipment.
- d. When setting the Averaging Period Adjustment Factors, assume the source is continuously emitting when adjusting to longer averaging periods.
- e. Remember to take appropriate steps to maintain a record of your individual HARP runs (i.e., rename your rsk files).
- f. Remember to save (and rename) the site parameter and emission files.
- g. Where needed, refer to Chapter 8 of the OEHHA Guidelines, HARP Tips to Remember; the HARP User's Guide, or your class notes/slides.
- h. If possible, it may be useful to print the risk output files; especially, when questions pertain to the results at the point of maximum impact (PMI). These files may be useful when answering multiple questions.

NOTE: Starting with question 2, the answers to each question may build upon the files created in previous questions. Check your answers as you go to make sure you are progressing correctly.

Risk Questions:

1. Following the Tier 1 requirements of the OEHHA Guidelines for this facility, what is the correct risk analysis method that you will use on the Risk Reports Window? Why?
2. Using the correct analysis method, find the offsite grid receptor(s) with the highest cancer, noncancer chronic, and noncancer acute health impacts. (Hint: remember to use the sort function while viewing the health impacts for each calculation on the risk tab.)
3. For this receptor, also called the Point of Maximum Impact (PMI), identify the potential cancer risk and driving pollutant(s) for the inhalation pathway.
4. For receptor 884, determine the Derived (OEHHA) and Derived (Adjusted) Cancer Risk using the mandatory pathways.

- b. What is the difference between the Derived (OEHHA) and Derived (Adjusted) calculations?
 - c. Does the difference between these methods impact the results for any substance(s)? If so, which one(s)?
5. Select the site parameter file called *demo.sit* from the "Demo" project directory. Make sure this file includes the required pathways/information then save and rename the file in the current project directory. For receptor 884, determine the Derived (OEHHA) and Derived (Adjusted) Cancer Risk for all pathways.
6. For receptor 884, determine the Chronic Hazard index (HI) using the proper method, the driving pollutant(s), and target organ(s) or endpoint(s). Is the Derived (Adjusted) method appropriate? Why?
7. For receptor 884, determine the Acute HI, the driving pollutant(s), and target organ(s) or endpoint(s).
8. Under the Emission Tab, add 300 pounds/year and 1 pound/day of benzene to process 2 and save (rename) the emission (EMS) file. Rerun the cancer risk using mandatory pathways and the ARB's Interim Risk Management Policy. Which receptor is the PMI?
 - b. What is the total potential multipathway cancer risk?
 - c. What is the potential inhalation cancer risk?
 - d. What is the Acute HI and what are the driving pollutants and target organs (endpoints)?
9. Using the PMI receptor and new EMS file for question 8, add an annual background concentration of chromium VI at $1E-3\mu\text{g}/\text{m}^3$ and save (rename) the EMS file. Determine the inhalation and multipathway (mandatory pathways) cancer risk using the Interim Risk Management policy. What are the inhalation and multipathway cancer risks?
 - b. Observe the cancer risk contributions by each pollutant and identify the driving pollutant and cancer risk?
 - c. Did the Acute HI change? Why?

10. Using the PMI results and new emission files from question 9, reduce TCDD emissions by 99% and increase 10-fold the emissions of the pollutant that is the smallest contributor to the multipathway cancer risk. Using the renamed demo.sit file that was saved in question 5, find the Derived (OEHHA) Cancer Risk.

11. For the emission file and results used in question 10, remove the fish pathway from your site parameters file. What is the Derived (OEHHA) Cancer Risk?

b. What percentage would you need to reduce the emissions of Process 2 to get the total cancer risk for this process below 10 chances per million? (Partial Hint: to see only the contribution for a selected process, remember to remove the background contribution of any substances. This can be done two ways using the emissions tab: 1) Delete any chemical with a background concentration; or 2) Set the multipliers for each substance to zero (0) and delete the background concentration.

c. What substances are emitted by process 2 and where would you find this information?

d. Using the results from the Derived OEHHA cancer risk (question 11), identify the risk and driver information. In the table below, by process and for the background, list the cancer risk and percent contribution of each pollutant in descending order. Identify the three driving pollutants.

Gilda's Gadgets				
Origin of Pollutant	Name of Pollutant	Cancer Risk (chances per million)	Percentage of Total Risk	Driving Pollutants (place x)
Process 1	TCDD			
	Arsenic			
Process 2	Formaldehyde			
	Benzene			
Background	Chromium IV			
Total Cancer Risk for Receptor				

e. Why is the risk so low for substances emitted through process 2 when they have the largest annual emissions? Where do you find the information to answer this question?

Answers To Dispersion Question:

1. Not necessary. When you run dispersion, HARP asks if you want to save the hourly X/Q data. The hourly X/Q data is used to calculate the refined acute hazard indices. You only run a refined acute analysis if:
 - a. One of the substances emitted from your facility has an acute health value;
and
 - b. You have two or more spatially separated release points.

Reminder: If you think you will want to evaluate impacts with a refined acute analysis later, you must say “yes” to this question or come back and rerun your air dispersion modeling.

Answers To Risk Questions:

1. Use a button that includes the Derived (OEHHA) method. This method will be used for both the cancer risk and chronic noncancer calculation.
Arsenic and 2,3,7,8 TCDD are multipathway pollutants.
2. Receptor 884 is the highest receptor for all three (i.e., cancer risk, chronic HI, acute HI).
3. Inhalation Cancer Risk is 7.64 E-6; TCDD @ 5.97 E-6 is driver.
4. Derived (OEHHA) = 1.44 E-4.
Derived (Adjusted) = 1.44E-4.
 - b. Under the Derived (Adjusted) method, the high-end daily breathing rate (DBR) is replaced with the 80th percentile DBR.
 - c. There is a difference in the inhalation risk contribution for formaldehyde. The high-end daily breathing rate (DBR) was replaced with the 80th percentile DBR. This did not significantly impact the total risk for the receptor since formaldehyde (through the inhalation pathway) is not a significant contributor to the total risk. Formaldehyde risk changed from 7.0 E-7 to 5.38E-7.
5. Derived (OEHHA) = 4.48 E-2.
Derived (Adjusted) = 4.48E-2.
6. Derived (OEHHA) =38.7 Chronic HI; Driver: is TCDD.
Endpoints: Developmental, Endocrine, GI/liver, Reproductive, Blood, and Respiratory.

No. The Derived (Adjusted) method is not applicable because this method is only used to address the Risk Management (RM) Policy which applies only to

inhalation-based carcinogenic risk assessments. In addition, a dose calculation is required for the Derived (Adjusted) method. The inhalation dose calculation incorporates the use of a daily breathing rate (DBR). The 80th percentile DBR is substituted for the high-end DBR in the Derived (Adjusted) methodology. The calculation of an inhalation chronic HI uses the annual concentration (GLC) divided by the inhalation REL; instead of calculating an inhalation dose.

7. Acute HI = 26.4; Driver is Formaldehyde.

Endpoints: Eye,

8. Using Derived Adjusted Methodology, the PMI is receptor 884.

Derived Adjusted - Multipathway = 1.48E-4.

Derived Adjusted - Inhalation = 1.13 E-5.

Acute HI is 26.4; Driver is Formaldehyde; Endpoint is Eye.

9. Inhalation = 1.59 E-4

Multipathway = 2.95 E-4

b. Chromium IV risk is 148 per million; TCDD risk is 133 per million.

c. No. Chromium IV does not have an acute reference exposure level.

10. Derived (OEHHA) = 6.70 E-4

11. Derived (OEHHA) = 2.13 E-4

b. Using your hand calculator, Process 2 would need to reduce risk by approximately 17 percent, or by using a multiplier of 0.83 to get the risk below 10 chances per million for that process only. Note that significant risk remains from other pollutants.

c. The pollutants in process 2 are formaldehyde and benzene. This information is found on the risk report printout or on the emissions tab.

d. See table below:

Gilda's Gadgets				
Origin of Pollutant	Name of Pollutant	Cancer Risk (chances per million)	Percentage of Total Risk	Driving Pollutants (place x)
Process 1	TCDD	38.4	14.8	x
	Arsenic	17.4	6.7	x
Process 2	Formaldehyde	7.0	2.7	
	Benzene	5.0	1.9	
Background	Chromium IV	192	73.8	x
Total Cancer Risk for Receptor 884		206		

e. The health factors (cancer potency factors) are smaller for the Process 2 substances. Health factors can be seen on the HARP printouts, HARP Health Table, Consolidated Table of Health Factors, and the OEHHHA Guidelines.