HEALTH RISK ASSESSMENTS FOR TWO RESOURCE RECOVERY FACILITIES USING ESTIMATED (PERMITTED) AND ACTUAL EMISSION LEVELS

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Abstract

Health Risk Assessments (HRAs) for two Ogden Martin Systems, Inc. resource recovery facilities were based either on emissions estimated from databases available prior to construction or on actual emissions determined from compliance testing performed after start up of the facility. Estimated emissions were used in the initial HRA for the Stanislaus County, CA facility, while the permit required an evaluation based on actual emissions obtained from testing during operation. The Babylon, NY facility permit required that the HRA be performed only after the facility was operating.

Introduction

Stanislaus: The initial HRA was performed in 1986 by Radian Corporation[1], under contract to OMS and was based on estimated carcinogenic airborne emissions as shown in Table 1. Table 2 summarizes the cancer risk for Case 1 and Case 2 exposure scenarios from substances known or suspected to be carcinogenic. Case 1 (moderately conservative, and therefore more likely to occur) and Case 2 (more conservative and less likely to occur) include different assumptions for 2,3,7,8-TCDD toxic equivalent (TEF) emissions, which are in California Department of Health Services (DHS) TEFs, approximately two times larger than I-TEFs.

Babylon: The HRA for this facility was done by Health Risk Associates, Berkeley, CA[2], under contract to OMS of Babylon, Inc. after initial performance stack test results became available. The protocols for both HRAs were approved by the appropriate state and Federal agencies prior to completion of the HRAs.

Results

Stanislaus: Table 1 also provides the actual annual average carcinogenic airborne emissions based on stack testing. Three subsequent quarterly

Table 1. Summary of Estimated and Actual Carcinogenic Airborne Emissions from the Stanislaus County Resource Recovery Facility(a)

Pollutant	Estimated Annual Average Emissions (g/s)	Actual Annual Average Emissions (g/s)	Percentage: Actual vs. Estimated (%)
Arsenic (As)	1.1E-04	5.3E-05	48
Beryllium (Be)	2.7E-06	2.0E-08	1
Cadmium (Cd)	7.2E-04	8.2E-05	12
Chromium (Cr)	4.5E-03	4.7E-04	10
Nickel (Ni)	3.7E-03	9.7E-04	26
PCBs	1.0E-05	6.8E-06	68
PAHs	4.5E-04	1.2E-04	26
PCDD/F (Case 1)(b)	6.1E-07	1.6E-08	3
PCDD/F (Case 2)	1.7E-06	1.6E-08	1

(a)Emissions are based on 8016 hours of operation per year.
(b)California DHS TEFs.

dioxin tests and the next annual test replicate the initial dioxin results. Table 2 shows the updated cancer risk by various pathways for Case 1 and Case 2 scenarios using these actual emissions. The total cancer risk based on actual emission levels is 14 to 24 times lower than originally estimated.

Babylon: A comprehensive HRA was undertaken using actual stack emissions from the Babylon facility. The maximum average ground level concentrations (GLC) of all emissions were much lower than existing levels, e.g., the maximum average GLC estimated for arsenic was more than 500 times lower than previously measured in suburban samples in New York, while the concentration of dioxins was 33 times lower than existing levels measured in West Babylon before the facility began operation. Thus, even at maximum GLC, the emissions would not make a significant impact on existing levels. Upper limit estimates of cancer risk were calculated and all pathways of exposure were considered including inhalation of air, contact with dust and soil, inhalation of resuspended dust and soil, consuming vegetables from a home garden, and fish consumption from a local lake. Table 3 presents the details on the estimate of cancer risk.

Conclusions

When both HRAs are compared for cases where real emission data are used, risk levels are insignificant based on North American governmental agency criteria for risk management. Use of expanded emission databases will continue to require regulatory understanding that not-to-exceed permit and contractual

Table 2. Case 1 and Case 2 Cancer Risk Per Million Determined by Using *Estimated* Emissions Developed Prior to Startup of the Stanislaus County Resource Recovery Facility and Recalculated Using Actual Tested Emissions

Chemical	Soil Est/Act	Plant Est/Act	Dairy Est/Act	Fish Est/Act	Dermal Est/Act	Milk Est/Act	Inhal Est/Act	Total Est/Act
Case 1								
As	* / *	0.03/0.02	* / *	* / *	* / *	---	* / *	
Be	* / *	* / *	* / *	* / *	* / *	---	* / *	
Cd	* / *	* / *	* / *	* / *	* / *	---	0.02/ *	
Cr	0.07/ *	0.42/0.04	* / *	* / *	0.01/ *	---	0.61/0.06	
Ni	0.01/ *	0.09/ *	* / *	* / *	* / *	---	0.01/ *	
PAH	* / *	0.05/0.01	0.02/ *	0.11/ 0.03	* / *	---	0.02/ *	
PCB	* / *	* / *	* / *	* / *	* / *	---	* / *	
PCCD1	0.02/ *	0.39/0.01	0.09/ *	0.03/ *	* / *	0.51/0.01	0.25/ *	
Case 1	0.1/0.01	0.92/0.09	0.11/0.01	0.14/0.03	0.02/ *	0.51/0.01	0.92/0.08	2.7/0.2
Case 2								
As	0.02/ *	0.11/0.05	* / *	* / *	* / *	---	0.01/ *	
Be	* / *	* / *	* / *	* / *	* / *	---	* / *	
Cd	0.05/ *	0.32/0.04	* / *	* / *	* / *	---	0.04/ *	
Cr	1.87/0.19	12.4/1.3	* / *	0.02/ *	0.07/ *	---	1.43/0.15	
Ni	0.04/0.01	0.28/0.08	* / *	* / *	* / *	---	0.03/ *	
PAH	0.05/0.01	0.35/0.09	0.09/0.02	0.52/0.13	* / *	---	0.04/0.01	
PCB	* / *	* / *	* / *	* / *	* / *	---	* / *	
PCCD2	0.14/ *	20.0/0.19	1.05/0.01	0.19/ *	0.02/ *	6.45/0.06	1.66/0.02	
Case 2	2.16/0.24	33.4/1.7	1.14/0.03	0.74/0.14	0.09/ *	6.45/0.06	3.22/0.19	47.2/2.4

* = < 0.01

Table 3. Lifetime Cancer Risks Per Million

From dioxin and furan emissions, all pathways			0.213
From heavy metals			
antimony		0.0034	
arsenic	inhalation	0.0231	
	ingestion	0.0087	
beryllium		0.0082	
cadmium		0.0048	
chromium VI		0.000005	
nickel		0.004	0.052
From other trace organics by inhalation			
selected PAHs		0.041	
PCBs		0.008	
formaldehyde		0.031	0.080
From other trace organics, other pathways			0.033
Total cancer lifetime risks from all emissions			0.38

guarantees based on limited testing must give way to the use of annual average or "typical" emissions. NYSDEC recognizes and codifies this concept; there are four levels for dioxin emissions: 1) a level never to be exceeded, 2) a level used as a design goal that is near the lowest achievable level, 3) the upper boundary of a 95% confidence interval of five years of testing every nine months (12 tests), which becomes the permitted level, and 4) the actual mean level of dioxin emissions during the five years of testing. Thus, the difference between the never to exceed and/or upper bound limit level versus the mean value is the difference between the current concept of permitted levels versus typical levels. The NYSDEC's dioxin emission goal is close to the regulatory level currently being discussed in Europe, while "typical" dioxin emissions from OMS's resource recovery facilities are at or below this level.

References

1. Radian Corporation, "Stanislaus Waste-to-Energy Facility Health Risk Assessment," DNC 86-243-079-14, October 1986.
2. Smith, A.H and H.M. Goeden, "Health Risk Assessment for the Babylon Resource Recovery Facility." Health Risk Associates, Berkeley, CA, April 1989.