Background Document on Additional HWIR Chemicals in Support of the Hazardous Waste Identification Rule October, 1999

Introduction

This document discusses the approach used to select additional chemicals for which exemption levels might be developed using the HWIR 3MRA risk assessment modeling approach. Developing exemption levels for additional chemicals would allow more waste to become eligible for the HWIR exemptions discussed in the 1999 preamble. There are, however, over 430 chemicals included within the list of HWIR Exemption Chemicals[1], but certainly not all of these are present in the vast majority of waste streams. We therefore suggest that we do not need to develop exemption levels for all of these chemicals to make the HWIR exemptions available to a broad segment of the waste universe.

There are, of course, many ways in which chemicals might be prioritized for exemption level development; we present the basis for our next set, which we believe is a reasonable approach, but recognize that there are certainly other ways of selecting such chemicals. Unlike the criteria used to select the initial set of 42 chemicals, this second set of chemicals more explicitly seeks to expand the regulatory relief afforded by the HWIR exemptions.[2] As part of the preamble discussion, we explicitly request comment on which chemicals and waste streams might be especially suited to an HWIR exemption, and therefore deserve higher priority.

Criteria for Considering Additional Chemicals

Our prioritization efforts focused on waste streams most likely to take advantage of the HWIR exemptions. By analyzing data on historic cost savings and the prevalence of chemicals within both large and small waste streams, we identified an additional 29 chemicals that with exemption levels could increase the number of RCRA waste codes, facilities, and volumes of waste eligible for the HWIR exemptions.

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[1] The set of HWIR Exemption Chemicals and its derivation is discussed in another background document entitled *Background Document on HWIR Exemption Chemicals*, U.S. EPA, September, 1999.

[2] See section XVII.C of the preamble as well as the *Background Document on the Selection of Initial Chemicals*, U.S. EPA, September, 1999 for a discussion of the selection criteria for the initial 42 chemicals considered for exemption level development.

How were historic cost savings considered?

This analysis relies on the Regulatory Impact Analysis performed in support of the 1995 HWIR proposal[3]. Although the risk assessment that formed the basis of the 1995 proposal is substantially different than the one being developed and discussed in the 1999 proposal, the 1995 information on cost savings is the most comprehensive examination of HWIR eligible waste streams and associated cost savings to date.[4] Cost savings consisted of savings from treatment and disposal and are expressed as $/year. As exemption levels are developed, a new evaluation of cost impacts can be made and the prioritization of chemicals developed here can be revisited. In the nearer term, the revised economic model developed for the 1999 proosal has enhanced capabilities that may allow additional examination of priority chemicals.[5] Such analyses were not pursued in preparation of this notice because of time and resource constraints.

How was the specific set of 29 additional chemicals chosen?

The methodology used to determine the next set of chemicals for which we might develop exemption levels is described through the following steps. Again, the overall goal was to focus on chemicals prevalent in waste streams that were found to save claimants the most money. Other criteria included a desire to maximize the volumes of waste that would eventually be eligible for exemption under HWIR and to consider such eligibility not only for large waste generators but also for smaller generators.[6]

Step 1: In the Regulatory Impact Analysis from the 1995 HWIR proposal, the universe of waste streams was considered by industrial sector and segmented into two groups: large (greater than 10,000 tons generated per year) and small (less than 10,000 tons generated per year). Cost savings by industrial sector for these two groups is presented in the

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[3] That analysis considered waste eligibility associated with assigned exemption levels for 220 chemicals. See U.S. EPA, *Assessment of the Potential Costs and Benefits of the Hazardous Waste Identification Rule for Industrial Process Wastes, As Proposed*, 1995.

[4] The 1999 economic assessment focuses on other revisions to the mixture and derived-from rules. Only a few example exemption levels were developed as part of the regulatory docket, and a formal economic analysis on these example levels was not performed.

[5] The HWIR economic model has been designed to provide data about the prevalence of constituents in waste streams and to identify those constituents that often "limit" a waste stream from gaining exemption under HWIR (i.e., identify the only constituent that does not have and meet an established exemption level for a particular waste stream.

[6] Eligibility of the exemption to small business is being considered in this analysis as those waste streams emanating from small generators. Strictly speaking, small generators are not necessarily small businesses and vice versa.

appendix to that document.[7]

Step 2: For large and small waste streams, the cost savings realized within each 4-digit SIC industry group was identified by industrial sector and ranked. Both waste stream volumes within these industrial groups as well as the number and identification of constituents reported within these waste streams were tallied. This information is presented in Table 1.

Step 3: Within the small and large group, we chose industrial sectors among the top ten (again, ranked by cost savings) which had a limited number of constituents reported (i.e., less than 40 constituents). These sectors are identified in Table 1 by "***". The 45 distinct chemicals found in the above sectors with less than 40 constituents are listed in Table 2. Note that 20 of the 45 chemicals identified are already being considered by HWIR in its initial set of chemicals.[8]

The fewer constituents reported, the greater the probability that the waste stream would be eligible for the HWIR exemption; eligibility, of course, does not presuppose that these waste streams would be able to meet the exemption levels, only that there would be exemption levels available for the claimant to consider.

We observed that by using this criteria, we selected 8 of the 10 top small waste streams, but only 2 of the top 10 large waste streams. From this set of data, we observe that smaller streams (those higher "cost-savers" at less than 10,000 tons per year) generally have fewer constituents than larger streams. We note that the separation of large and small streams and the representation by smaller streams in the narrowed set retains a desired sensitivity for small businesses / small generators not to be excluded from HWIR eligibility.

On the other hand, we observed that none of the waste streams chosen were from the Chemical and Allied Products sector. Chemical and Allied Products was the top industry sector for cost savings when considered by 2-digit SIC codes. 6 of the 10 top large streams were from the Chemical and Allied Product industries, but none were chosen in this step.

[7] See specifically, Exhibits F-4a and F-4b: Calculation of Net Savings Attributable to HWIR Exemption for Large (F-4a) and Small (F-4b) Waste Streams, pgs. F-14 and F-15.

[8] Again, see *Background Document on the Selection of Initial Chemicals*, U.S. EPA, October, 1999

TABLE 1

TOP-10 INDUSTRY SECTOR BENEFICIARIES EXPECTED UNDER 1995 HWIR:
DESCENDING SORT BELOW BY POTENTIAL WASTE MANAGEMENT COST SAVINGS

(Source: Based on 25 May 1995, IEC Inc. and Versar Inc, HWIR RIA report, Appendix F pp.F14, F15).

HWIR95 savings rank	Industry Group	SIC code	Eligible waste volume (tons)	Potential avg. annual HWIR savings*	1996 NHWCS nr. of constituents	
A. TOP-10 SECTORS WITH LARGE WASTESTREAMS (>10,000 tons/yr):						
1	Semiconductor mfg.	3573	26,650	$8,028,000	6	***
2	Petroleum refining	2911	25,500	$7,681,000	189	
3	Chemicals & Allied Products	28	130,435	$5,687,000	see (b)	
4	Semiconductor mfg.	35/36	18,717	$5,638,000	see (c)	***
5	Chemicals & Allied Products	28	14,412	$4,341,000	see (b)	
6	Chemicals & Allied Products	28	12,998	$3,915,000	see (b)	
7	Petroleum refining	28/29	29,483	$3,425,000	see (b)	
8	Chemicals & Allied Products	28	110,000	$3,195,000	see (b)	
9	Chemicals & Allied Products	28	10,356	$3,120,000	see (b)	
10	Aircraft mfg.(space propulsion)	3764	10,202	$3,073,000	30	***
	Total Large Top-10=	-------	388,753	$48,103,000	**541**	
	Subtotal of large streams designated by *** above =		55,569	$16,739,000		
B. TOP-10 SECTORS WITH SMALL WASTESTREAMS (<10,000 tons/yr):						
1	Petroleum refining	2911		$82,941,000	189	
2	Semiconductor mfg.	3573		$20,593,000	6	***
3	Semiconductor mfg. (electronic components nec)	3679		$17,654,000	8	***
4	Semiconductor mfg. (electroplating, coloring)	3471		$9,103,000	11	***
5	Semiconductor mfg. (related services)	3674		$4,474,000	39	***
6	Aircraft mfg.	3724		$4,289,000	38	***
7	Semiconductor mfg.	3429		$3,833,000	36	***
8	Aircraft mfg.	3721		$2,574,000	39	***
9	Petroleum refining (cyclic organic crudes)	2865		$2,161,000	106	
10	Semiconductor mfg.	3662		$1,967,000	13	***
	Total Small Top-10=	-------		$149,589,000	**214**	
	Subtotal of small streams designated by *** above =			$64,487,000		
C. TOTAL 1995 HWIR-ELIGIBLE INDUSTRY WASTESTREAMS:				$197,692,000		
	All 46 beneficiary sectors (2-digit SIC code level)	-------	239,560,000	$235,900,000		
	Subtotal of sectors designated by *** above =			$81,226,000		

Explanatory Notes:

(a) * Potential savings extracted from Appendix F of the 25 May 1995 reference document, assumed by EMRAD as applicable to the 1995 HWIR "MPN (multipathway number) with DAF 10" proposed option, modified by Versar Inc. with a "waste minimization" scenario which simulated extra industry savings, relative to IEC's RIA baseline savings of $66.6 million (9,100 wastestreams, 5,300 facilities). Unfortunately, savings by 4-digit level SIC codes were not generated in the 1995 RIA by IEC for the base savings scenario. Also note that savings are derived from 1995 HWIR exit levels calculated for 218 waste constitutents. Waste stream and constituent information is based on the 1986 Generator survey.

(b) Four-digit 28xx level not specified in the 1995 RIA report for the top large wastestream rank-order; however consists of following:

C & A.P. (industrial inorganic chemicals)	2819	119
C & A.P. (plastics, synthetic resins & elastomers)	2821	206
C & A.P. (cyclic organic crudes & intermediates)	2865	106
C & A.P. (industrial organic chemicals. nec.)	2869	399
C & A.P. (pesticides & agricultural chemicals)	2879	140

(c) Large volume semiconductor not specified in 1995 RIA; see corresponding SIC codes under small volume.

(d) *** Non-duplicative count of constituents for nine SIC codes above with less than 40 constituents equals **45**
Non-duplicative counts for the top 10 large and top 10 small secotrs are 541 and 214 respectively.

TABLE 2
Initial Set of Additional Chemicals from Industrial Sectors with High Cost Savings (a)
(Ranked Below by Number of Wastestreams)

Rank item	CAS Nr.	Chemical Name	Nr. of NHWCS waste streams in the nine SIC sectors	Nr. of NWHCS wastestreams in all SIC codes (if chem. mass >0)	"X" if included in initial 42 HWIR99 chemicals**	Nr. of SIC= 28XX NHWCS wastestreams (if chem. mass >0)
1	7440-47-3	Chromium	30	328	X	71
2	7440-43-9	Cadmium	26	268	X	43
3	7439-92-1	Lead	25	370	X	43
4	7440-02-0	Nickel	24	171	X	40
5	7440-22-4	Silver	22	188	X	30
6	57-12-5	Cyanides	21	132		27
7	71-43-2	Benzene	11	299	X	98
8	108-88-3	Toluene [Methylbenzene]	10	355	X	135
9	67-64-1	Acetone [2-Propanone]	10	290		113
10	78-93-3	Methyl ethyl ketone [2-Butanone][MEK]	10	261	X	77
11	127-18-4	Tetrachloroethylene [Perchloroethylene]	10	190	X	53
12	79-01-6	Trichloroethylene	10	159	X	50
13	67-56-1	Methanol [Methyl alcohol]	9	212		120
14	1330-20-7	Xylenes, mixed isomers [Xyenes, total]	9	305		95
15	75-09-2	Methylene chloride [Dichloromethane]	9	233	X	84
16	141-78-6	Ethyl acetate	9	193		62
17	108-10-1	Methyl isobutyl ketone [Hexone][4-Methyl-2-pentanone]	9	199		62
18	100-41-4	Ethylbenzene	9	213		57
19	71-55-6	1,1,1-Trichloroethane [Methyl chloroform]	9	190	X	52
20	71-36-3	n-Butyl alcohol [n-Butanol]	9	164		47
21	108-90-7	Chlorobenzene	9	120	X	44
22	110-86-1	Pyridine	9	97	X	37
23	56-23-5	Carbon tetrachloride	9	105		37
24	98-95-3	Nitrobenzene	9	86	X	27
25	79-00-5	1,1,2-Trichloroethane [Vinyl trichloride]	9	81		26
26	78-83-1	Isobutyl alcohol	9	84		24
27	95-50-1	1,2-Dichlorobenzene [o-Dichlorobenzene]	9	79		24
28	108-94-1	Cyclohexanone	9	73		21
29	75-15-0	Carbon disulfide	9	71	X	20
30	60-29-7	Ethyl ether [Ethane 1,1'-oxybis]	9	69		20
31	75-69-4	Trichlorofluoromethane [Trichloromonofluoromethane][CFC-11]	9	70		19
32	1319-77-3	Cresols, mixed isomers	9	71		19
33	95-48-7	o-Cresol [2-Methyl phenol]	9	81		18
34	76-13-1	1,1,2-Trichloro-1,2,2-trifluoroethane [Freon 113]	9	80		17
35	106-44-5	p-Cresol [4-Methyl phenol]	9	82		16
36	108-39-4	m-Cresol [3-Methyl phenol]	9	74		14
37	7440-66-6	Zinc	4	73	X	15
38	7440-50-8	Copper	4	57		9
39	7440-39-3	Barium	3	219	X	44
40	7440-38-2	Arsenic	3	215	X	35
41	110-80-5	2-Ethoxyethanol [Ethylene glycol monoethyl ether][Cellosolve]	3	65		17
42	79-46-9	2-Nitropropane	3	44		7
43	107-06-2	1,2-Dichloroethane [Ethylene dichloride]	1	70		33
44	7782-49-2	Selenium	1	129	X	17
45	7440-32-6	Titanium	1	2		1
		Column totals =	49		20	

Explanatory Notes:

(a) Sort-consolidation of extracted 1996 NHWCS data to reveal the 45 consolidated constituents which correspond to the 9 under-40 constituent HWIR95 industry beneficiaries (SIC CODES = 3573, 3764, 3679, 3471, 3674, 3724, 3429, 3721, 3662)*

(b) Nine-sector subtotal facilities in NHWCS = 24 (note that the NHWCS does not contain small wastestream volumes).

(c) Nine-sector subtotal number of wastestreams in NHWCS = 49

(d) Nine-sector subtotal wastestream volume in NHWCS = 25.54 million tons.

(e) Number of wastestreams with >0 constituent mass may understate the number of wastestreams actually containing a particular constituent, because the constituent is: (a) present but has not been measured by a facility, or it was measured but the concentration was below the "level-of-detection" for the measurement test method applied by the facility or its lab.

(f) ** The list of initial 42 industrial hazardous waste constituent chemicals can be found in the HWIR preamble.

Step 4: Chemicals were added from the Chemical and Allied Product industries to correct this under-representation from the highest cost saving 2-digit SIC sector. A set of chemicals were selected from those found in more than 20 chemical industry waste streams. This set of chemicals is presented in Table 3.

Here we supplement our cost savings focus to include chemicals that are generally prevalent across waste streams.

In Steps 3 and 4, we have sought to focus on waste streams that had few constituents (less than 40) or on chemicals present in a significant number of streams within the chemical industry (more than 20 streams). We recognize that the specific numbers of 40 and 20 are somewhat arbitrary, but allow for the selection of a managable number of chemicals to consider. Additional analysis and different thresholds could expand this list.

Step 5: The 25 chemicals from Table 2 not found in the initial 42 and the 16 chemicals listed on Table 3 result in a list of 41 chemicals. 12 chemicals are removed from consideration for the following reasons:

Chemicals not found on the broader set of chemicals of concern (HWIR exemption chemicals) were removed from consideration. This criterion removed Titanium (7440-32-6), Ammonia, gas (7664-41-7), 2-Propanol (67-63-0), Ethanol (64-17-5), n-Butyl acetate (123-86-4), Isopropyl acetate (108-21-4), Methyl acetate (79-20-9), n-Hexane (110-54-3), n-Propyl alcohol (71-23-8), and n-Heptane (142-82-5).

As discussed in the HWIR99 preamble, the modeling of cyanides (57-12-5) presents particular technical challenges. Such challenges stem from the complex chemistry of cyanide and the presence of cyanide in various forms. In addition, the chemical analysis of cyanide is complicated by significant interferences and the reporting of various cyanide forms, including total, free and weak acid dissociable forms. The decision as to whether cyanide should be a high priority chemical for exemption level development was deferred, and hinges not only on the technical difficulties mentioned, but also upon the realistic prospects of cyanide bearing waste being otherwise good candidates for the HWIR exemption.

Cresols, mixed isomers (1319-77-3) was removed from the list because this mixture is represented by its three isomers: meta-Cresol(108-39-4), ortho-Cresol(95-48-7), and para-Cresol(106-44-5).

As a result, the following 29 chemicals found in Table 4 have higher priority as we contemplate the further development of exemption levels. As we discuss in the HWIR99 preamble, we are very interested in the opinions of potential HWIR claimants concerning this list, alternative lists and alternative criteria for selecting chemicals for exemption level development.

TABLE 3
Prevalent Chemicals from Chemical and Allied Product Industry (a)

(Ranked Below by Waste stream Volume)

Rank item	CAS Nr.	Chemical Name	Nr of NHWC wastestream (if chem. mass>0)*	Nr of all NHWCS waste streams	NHWCS quantity of waste (tons)	NHWCS chem.mass in waste (tons)
1	79-10-7	Acrylic acid	17	19	8,779,506	14,945
2	64-18-6	Formic Acid	11	11	7,761,590	894
3	79-06-1	Acrylamide	16	17	7,171,461	2,467
4	7664-41-7	Ammonia, gas	15	15	6,802,835	34,163
5	67-63-0	2-Propanol [Isopropyl alcohol][Isopropanol]	51	51	3,693,210	5,368
6	118-74-1	Hexachlorobenzene	14	32	3,306,619	623
7	67-72-1	Hexachloroethane	13	32	2,303,801	672
8	109-99-9	Tetrahydrofuran	36	42	1,120,245	2,875
9	98-86-2	Acetophenone	12	31	127,500	12,592
10	64-17-5	Ethanol [Ethyl alcohol]	46	47	118,571	5,648
11	123-86-4	n-Butyl acetate	28	28	80,637	1,650
12	108-21-4	Isopropyl acetate	20	20	65,167	1,057
13	79-20-9	Methyl acetate	14	14	59,904	2,257
14	110-54-3	n-Hexane	32	32	55,189	3,894
15	71-23-8	n-Propyl alcohol [n-Propanol]	17	17	34,279	780
16	142-82-5	n-Heptane	17	18	28,318	2,396
		Column totals (non-duplicative) =		169	48,315,466	92,281

Explanatory Notes:

(a) List of constituents from industrial sector SIC Code = 28xx which are not included in other top-10 HWIR95 benficiary industry secot or in OSW's initial list of 42 chemicals for HWIR99.

(a) * Number of wastestreams with >0 constituent mass may understate the number of wastestreams actually containing a particular constituent, because the constituent is present but has not been measured by a facility, or it was measured but the concentration was below the "level-of-detection" for the measurement test method applied by the facility or its lab. Constituents are listed above only if reported in >10 wastestreams (with >0 mass) in the 1996 NHWCS database. We used this cut-off criterion for the purpose of generating a manageable candidate list of constituents prevalent in the SIC code 28XX sectors, as an approximating technique for maximizing industry cost-savings opportunities under HWIR99. However, selection of candidates for OSW's second set is limited to only 30-40 constituents above the initial list of 42, because of expected time constraints in running.

What Other Criteria Might Be Important in Selecting Additional Chemicals?

The focus for the selection of the above set of chemicals has been on historic cost savings across waste streams and within particular industrial sectors. Certainly, other criteria could have been used. Examples include more emphasis on maximizing volumes of eligible waste regardless of cost savings and regardless of the distribution of such waste across waste streams and across industries. We could also, have focused on particular waste streams and sought a set of chemicals that completely circumscribed a few waste streams from particular sectors.

Other considerations might include:

- chemicals found to be generally prevalent in waste;
- chemicals that further represent the chemical universe in terms of fate and transport (such chemicals might include Benzyl chloride (100-44-7), Formaldehyde (50-0-0), Methyl bromide (74-83-9), and Naphthalene (91-20-3));
- chemicals that completely describe chemical families linked to important waste streams (e.g., dioxins, polynuclear aromatics (PNA's), poly aromatic hydrocarbons (PAHs), polychlorinated biphenyls (PCBs))
- chemicals particularly amenable to treatment
- chemicals that enhance waste minimization efforts; etc.

We note that just as there are good candidates for additional exemption levels, there are other chemicals that are less attractive for exemption level development. The following types of chemicals may be of lower priority simply because they are not found in most process wastes generated today.

These chemicals include:

- chemicals no longer produced in the United States;
- chemicals produced infrequently or in small quantities;
- chemicals used exclusively as pesticides or herbicides; and
- chemicals found exclusively within discarded chemical products (that is, many of the RCRA P and U listed wastes found in 40 CFR 261.33).

These lower priority chemicals are unlikely to be prevalent in newly generated wastes, although they can appear in site clean-up wastes or contaminated media (for example, contaminated soil). While clean-up wastes and contaminated media may become exempt under HWIR by meeting the stated requirements, the main focus of today's rule is process wastes. Other regulatory mechanisms exist within the RCRA and CRCLA programs to direct the appropriate management of these wastes. Finally, we note that certain chemicals may be attractive from either a cost savings or prevalence perspective, but may present other issues with respect to risk assessment modeling. Such chemical specific issues could include the lack of toxicological information, particularly complex fate and transport within the environment or complex degradation processes. All of these aspects would need to be considered.

Conclusion

This document presented the specific methodology used to develop the additional set of chemicals that the Agency presents in the HWIR99 preamble as chemicals with higher priority for future exemption level development. The discussion identifies multiple criteria that could be used to establish such a set of chemicals. Because this concentration-based exemption is not being proposed in the HWIR99 notice, we have included this discussion to provide an opportunity for public dialogue on the chemicals that the Agency will develop for such an exemption in the future.

Table 4. Candidates for Additional HWIR Exemption Level Development

	CAS Number	Chemical Name
1	67-64-1	Acetone [2-Propanone]
2	98-86-2	Acetophenone
3	79-06-1	Acrylamide
4	79-10-7	Acrylic Acid
5	56-23-5	Carbon tetrachloride
6	7440-50-8	Copper
7	108-94-1	Cyclohexanone
8	95-50-1	Dichlorobenzene [ortho-Dichlorobenzene], 1,2-
9	107-06-2	Dichloroethane [Ethylene dichloride], 1,2-
10	110-80-5	Ethoxyethanol [Ethylene glycol monoethyl ether][Cellosolve], 2-
11	141-78-6	Ethyl acetate
12	100-41-4	Ethylbenzene
13	60-29-7	Ethyl ether [Ethane, 1,1'-oxybis]
14	64-18-6	Formic Acid
15	118-74-1	Hexachlorobenzene
16	67-72-1	Hexachloroethane
17	78-83-1	Isobutyl alcohol [2-methyl-1-propanol] [isobutanol]
18	108-39-4	meta-Cresol [3-Methyl phenol]
19	67-56-1	Methanol [Methyl alcohol]
20	108-10-1	Methyl isobutyl ketone [Hexone][4-Methyl-2-pentanone]
21	71-36-3	n-Butyl alcohol [n-Butanol]
22	79-46-9	Nitropropane, 2-
23	95-48-7	ortho-Cresol [2-Methyl phenol]
24	106-44-5	para-Cresol [4-Methyl phenol]
25	109-99-9	Tetrahydrofuran
26	76-13-1	Trichloro-1,2,2-trifluoroethane [Freon 113], 1,1,2-
27	79-00-5	Trichloroethane [Vinyl trichloride], 1,1,2-
28	75-69-4	Trichlorofluoromethane [Trichloromonofluoromethane][CFC-11]
29	1330-20-7	Xylenes, mixed isomers (ortho-, meta-, para-) [Xylenes, total]