CRI SITE SELECTION PROCESS

FINAL SITE SELECTION

High Risk Sites

The definition of high risk sites depends upon several factors:

- Amount of chemical exposure
- Length of time of exposure
- Variety of chemicals involved with the exposure
- Toxicity and carcinogenicity of chemicals involved in the exposure

Three types of high risk sites can be defined based on general history of the site in view if EPA procedures. *Superfund sites* are defined by the standard guidelines posed by EPA. *Superfund Applicant sites*, sites considered but not approved for Superfund programs, are also important, since these are typically highly productive, high profile, and have a long history of operation. Finally, *high chemical waste productivity sites* with neither of these histories are relevant due to local or state-wide history and due to the considerable influence they have on the local environment due to their high waste productivity.

Assigning Risk

As noted in an earlier section, to assign a relative carcinogenicity index to a given site, chemical profiles have to be assessed. Each chemical for which a report was filed has a relative risk assigned to it by EPA and assorted public and environmental health agencies. This risk does not imply actual carcinogenesis will take place, but rather infers an increased likelihood for such an event to happen should actual exposure and contact take place.

A number of chemical listings are available for defining site-related cancer risk. *EPA* produced its own listing of toxic chemicals (not necessarily implying carcinogenicity), and later, with the development of *IARC* produced a listing of chemicals of "suspected of confirmed toxicity." (Termed *CATOX* in this study). Other programs designed to increase chemical awareness include the *Public Awareness* listing and a listing of hazardous chemicals produced as a result of the *Community Right To Know* program.

The carcinogenicity of a given chemical type is further defined by a more detailed listing produced by researchers for NIH/CDC/ACI. In addition, by reviewing the environmental chemistry encyclopedia, the number of cited references for each chemical may be included in this review, assuming more carcinogenic substances will have a larger number of articles cited in the bibliography concerning their carcinogenicity. In essence, it is assumed that this number of articles published for a given chemical may be used as a barometer for public health-related knowledge and public awareness regarding the overall likelihood for carcinogenicity and overall likelihood that knowledge of this toxicological feature exists publicly. Another such indicator attempted in this study is the number of

Oregon sites which are listed as having this chemical, suggesting more attention may be paid to this chemical.

The latter assumptions imply that the most carcinogenic substances will not only have a large number of studies citing evidence for this claim, they will also have an increased likelihood for public awareness. For this reason, the following features were used to define the most toxic chemicals found in Oregon CRIs:

- Reported by EPA as toxic
- Reported by EPA's IARC as suspect or confirmed high toxicity
- Reported as part of the Public Awareness
- Reported as part of the Community Right To Know program
- Reported as suspected or confirmed carcinogen by EPA-guided group
- Reported as confirmed carcinogen by CDC/NIH/ACI
- Reported as suspected or confirmed carcinogen in the form of a significant number of articles published in chemical, toxicology, and medical journals.

These chemicals were ranked from most toxic to least toxic based on the sum of the indices derived from number of published articles and mention in toxicology reports and toxicity and carcinogenicity lists. This data was used to define what chemical and chemical groups are considered high risk to the general public.

Next, the sites have to be evaluated for their chemical history, with the goal of identifying the most toxic, most carcinogenic sites in Oregon.

As detailed in earlier sections, the following features of CRI sites impact the potential for carcinogenesis.

- Age of Site/Business
- Site use period (longevity of business)
- Site complexity (number of chemicals)
- Number of reports filed (implying repeated contamination or more severe spill events)
- Type of chemicals
- SIC

Excluded from this review are analyses of the following important chemical features: concentration levels in site-specific soil or water, environmental half-life of a given chemical, carcinogenicity/toxicology values for each chemical tested for at a site (versus the use of chemical groups, already method already discussed in detail in the previous chapter).

The following generalities may be posed regarding potential carcinogenicity for a given site.

Number of reports versus number of chemicals. A number of sites produced multiple reports for a single chemical. These reports may have been produced on the same day for a given large surface area for a CRI site, or they may represent a series of chronological reports filed for the same place for the same series of chemical tests utilizing identical or spatially-similar testing sites. In the case of the several reports filed during a short time, all reports were merged and considered a single chemical report. Such a CRI was evaluated as a single chemical site, and considered to be high risk only because of the total number of reports filed.

Chemical Complexity. Of the 524 sites with confirmed chemical release data, those of highest risk for possible carcinogenesis were determined by evaluating the chemical content of these sites. High risk sites were defined as sites which have a considerable amount of complexity to their chemistry.

Benzene Presence. Another example of high risk assignment involved sites which filed multiple reports for a number of fairly non- or low-toxic chemicals. Based on these chemicals alone, the site might be considered to be of low risk. However, the presence of benzene or other aromatic compound in this listing was considered ample reason to assigned a possible carcinogenicity to this site. This assumption is based on the argument that the benzene theory is true in so far as a possible link between aromaticity and carcinogenicity is concerned, to which is added the assumption that the increasingly complex environmental chemistry introduced by a large number of different chemicals may be linked to increased likelihood that chemical interactions might ensue, ultimately resulting in increased toxicity and carcinogenicity.

Data reading errors. In some cases of Chromium monitoring, only Chromium levels were reported for this site several times per year. This resulted in a lengthy list of tests, but with results for only one chemical—Chromium or hexavalent Chromium. Such a site, although high risk, was ranked low in chemical complexity-based toxicity and carcinogenicity concerns.

Three types of sites could be defined as low risk sites:

Single Chemical Exposure Sites. Contain one major toxin, for which numerous reports are filed and numerous field tests implemented. With the exception of high volume spills, risk of exposure at these sites at the local population level may be minimal. This risk is increased due to lack of or delayed clean-up, release of chemicals with long environmental halflives, and incomplete clean-up.

Simple Multi-chemical Exposure Sites. Contain between 2 and 7 toxins inclusively with accompanying reports. Variety in environmental chemistry is inadequate to pose a severe risk. This risk is increased by the release of chemicals with long environmental halflives.

Complex, Multi-chemical Exposure Sites. Produce five/seven or more toxins; may or may not result in the filing of numerous test reports.

The following criteria were used to identify the most toxic CRIs in Oregon (descriptions follow):

TABLE 7-1

SITES SELECTION PROCESS FOR HIGH RISK CRI SITES IN OREGON

CHEMICAL FEATURE	REASONING
PAH Reports > 8	Implies complexity of PAH profile for site, including the presence of heavier MW molecules with high carcinogenicity.
Aromatics at sites with >= 30 Reports	Implies complexity of potential carcinogenicity profile, including presence of benzene-based co-reactants.
Metals > 2; above 30-30 LINE	Implies complexity of metal profile, potential for metal co-reactivity and catalysis, and ability for metal interaction with carcinogenesis process.
Petrols at sites with > 30 Total Reports	Implies possible involvement of petrols with chemical activation, stabilization and diffusion processes.
Agritoxins at sites with > 30 Total reports	Implies complexity of total site chemistry; likelihood for interaction with other chemicals at site
Halogenic Aliphatic above 30-30 LINE	Implies complexity of total site chemistry
Halogenic Aromatic above 30-30 LINE	Implies complexity of total site chemistry

FIGURE 7-1 INSERT

RESULTS

A total of 509 of the original 524 CRI sites were analyzed using this approach, resulting in the identification of 22 High Risk Sites. Important to note is that many of these sites appear in the listing of sites considered for Superfunding. The types of sites in need of are in the following business categories: Wood products industries; Electronic Industries; Railroad facilities; Power Generating Facilities; Waste Disposal facilities; various Transportation and Motor Vehicle production and maintenance facilities or agencies.

The following are these sites:

1. Triangle Park - North Portland Yard
2. Union Carbide Corp.
3. GATX St. Helens RD Facility
4. Union Station - Track #5
5. Port of Portland - Terminal 4
6. Arrow Transportation Co. – Multnomah
7. US Postal Service Processing & Distribution Center – Multnomah (Portland)
8. Wyeth - Former Tie Treating Plant
9. Pacific Power & Light - Astoria Service Center
10. Texaco Portland Terminal
11. Unocal Terminal 0022 (Former) (also Bohemia Inc.)
12. UPRR - Eugene Yards
13. US Army COE - Portland Moorings
14. Portland (City of) - Former Refuse Incinerator
15. Rivergate Auto Wrecking - U Pull It Division
16. Chevron Bulk Plant (Former) – Astoria
17. Division of State Lands-Finger Piers N of Pier 2
18. Linnton Oil Fire Training Grounds
19. Oregon Air National Guard Base
20. Columbia Steel/Joslyn Sludge Pond
21. Wacker Siltronic Corp.
22. Chevron USA Asphalt Refinery

Over the years, these 22 businesses produced from 10% to more than 50% of the chemical reports for any of the common chemical groups or classes (TABLE 7-2). The most complex sites (producing large numbers of chemicals and a variety of groups) include waste dumps and industrial facilities several decades old, i.e. Wyeth Creosoting. Some are managed and operated by federal, state and local government officials. Others include an undeveloped site, an electronics industry, a metals industry, a power company, a chemical manufacturer, and several trucking maintenance and automobile parts/metal recovery businesses. FIGURES depicting the chemical profiles for each of these sites are found at the end of this section, along with a summary and comparison of this data with the CERCLA listing of most dangerous chemicals.

TABLE 7-2 INSERT

TABLE 7-3 INSERT

TABLE 7-4

OREGON VERSUS CERCLA HIGH RISK CHEMICAL LISTINGS

CERCLA RANK	OREGON Rank	CHEMICAL	CERCLA Points	OR CRI	OR SUPERFUND
5	1	BENZENE	1372.88	+	+
33	4	TETRACHLOROETHYLENE	1082.21	+	+
1	5	ARSENIC	1627.32	+	+
7	6	CADMIUM	1315.14	+	+
69	7	CHROMIUM	908.93	+	+
45	8	PENTACHLOROPHENOL	1022.95	+	+
8	9	BENZO(A)PYRENE	1285.71	+	+
67	11	DI(2-ETHYLHEXYL)PHTHALATE	923.15	+	+
38	12	BENZO(A)ANTHRACENE	1047.78	+	+
13	13	DDT, P,P'-	1183.5	+	+
49	14	NICKEL	1004.94	+	+
11	15	CHLOROFORM	1249.95	+	
17	16	DIBENZO(A,H)ANTHRACENE	1141.98	+	+
116	18	CHRYSENE	806.09	+	+
46	19	CARBON TETRACHLORIDE	1018.1	+	
9	20	BENZO(B)FLUORANTHENE	1257.85	+	+
74	22	1,2-DICHLOROETHANE	871.62	+	
244	22	DICHLOROETHANE	567.26	+	+
86	24	ASBESTOS	841.33	+	
129	24	AMOSITE ASBESTOS	802.59	+	
177	25	INDENO(1,2,3-CD)PYRENE	681.13	+	+
16	27	CHROMIUM, HEXAVALENT	1152.07	+	+
162	28	1,4-DICHLOROBENZENE	709.67	+	
258	29	STYRENE	532.74	+	
20	30	CHLORDANE	1121.25	+	
93	32	HEXACHLOROBENZENE	827.25	+	
30	34	HEPTACHLOR	1087.81	+	
44	36	BERYLLIUM	1023.27	+	+
12	39	AROCLOR 1254	1186.77	+	
82	40	2,4,6-TRICHLOROPHENOL	845.69	+	
47	42	COBALT	1011.99	+	+
6	44	POLYCHLORINATED BIPHENYLS	1340.07	+	+
64	45	TRANS-CHLORDANE	951.8	+	
52	46	HEPTACHLOR EPOXIDE	992.17	+	+
26	47	DDD, P,P'-	1104.19	+	
14	48	AROCLOR 1260	1182.97	+	
59	49	BENZO(K)FLUORANTHENE	972.84	+	+
71	49	BENZOFLUORANTHENE	907.82	+	+
195	50	CHROMIC ACID	612.79	+	
245	53	1,3-DICHLOROPROPENE, CIS-	565.36	+	
90	55	RADIUM	829.28	+	+
257	58	1,3-DICHLOROPROPENE, TRANS-	534.92	+	

CERCLA RANK	OREGON Rank	CHEMICAL	CERCLA Points	OR CRI	OR SUPERFUND
15	59	TRICHLOROETHYLENE	1160.83	+	+
4	60	VINYL CHLORIDE	1397.67	+	+
238	62	2,4-D ACID	579.53	+	
80	63	1,1,2,2-TETRACHLOROETHANE	851.93	+	
180	63	TETRACHLOROETHANE	668.57	+	
160	65	TRICHLOROETHANE	714.58	+	
151	66	1,1,2-TRICHLOROETHANE	750.84	+	
68	68	METHOXYCHLOR	916.15	+	+
19	72	HEXACHLOROBUTADIENE	1129.4	+	
77	73	2,4-DINITROPHENOL	867.3	+	
271	74	DICHLOROPROP	503.08	+	
169	75	TETRACHLOROPHENOL	695.54	+	
22	76	DDE, P,P'-	1117.44	+	+
34	77	AROCLOR 1221	1070.41	+	
78	78	2,4,6-TRINITROTOLUENE	866.63	+	+
29	79	AROCLOR 1242	1091.22	+	
172	80	CHLOROETHANE	693.13	+	
27	81	AROCLOR 1248	1098.88	+	
2	84	LEAD	1522.67	+	+
79	85	1,1,1-TRICHLOROETHANE	858.26	+	+
119	86	COAL TARS	805.52		
236	86	PYRENE	580.1	+	+
260	87	FLUORENE	527.13	+	+
232	88	PHENANTHRENE	598.61	+	+
265	91	ANTHRACENE	516.59	+	+
158	92	PHENOL	733.7	+	
136	93	COPPER	797.77	+	+
25	94	ALDRIN	1108.37	+	
18	95	DIELDRIN	1130.3	+	
145	98	1,1-DICHLOROETHANE	765.48	+	+
255	100	CRESOL, PARA-	536.97	+	
42	101	DI-N-BUTYL PHTHALATE	1028.68	+	
189	101	N-NITROSODIPHENYLAMINE	627.58	+	
143	102	PARATHION	772.49	+	
142	103	SELENIUM	777.71	+	
39	104	ENDRIN	1040.58	+	
84	107	ENDRIN ALDEHYDE	842.7	+	
234	108	DICHLOROBENZENE	585.31	+	
183	110	BUTYL BENZYL PHTHALATE	651.38	+	
3	111	MERCURY	1492.21	+	
53	113	ENDOSULFAN	990.07	+	
56	114	ENDOSULFAN, BETA	981.77	+	
138	115	MANGANESE	787.11	+	+
50	116	ENDOSULFAN SULFATE	1004.02	+	
48	118	ENDOSULFAN, ALPHA	1010.08	+	
241	119	ANTIMONY	572.91	+	+
196	120	SILVER	611.15	+	+
200	123	2-CHLOROPHENOL	608.08	+	
186	129	VANADIUM	633.08	+	+
250	130	2,6-DINITROTOLUENE	547.46	+	

CERCLA RANK	OREGON Rank	CHEMICAL	CERCLA Points	OR CRI	OR SUPERFUND
249	134	FLUORIDE	551.3	+	+
155	137	ACENAPHTHENE	743.04	+	+
252	139	4-NITROPHENOL	544.13	+	
230	140	1,2-DICHLOROETHYLENE	599.52	+	+
156	144	2-METHYLNAPHTHALENE	740.06	+	
179	146	1,2,3-TRICHLOROBENZENE	673.62	+	
251	146	TRICHLOROBENZENE	547.43	+	
89	148	CHLOROBENZENE	829.9	+	
170	150	CARBON DISULFIDE	695.24	+	
100	153	DIAZINON	814.01	+	
184	158	1,2,4-TRICHLOROBENZENE	648.73	+	
75	159	CYCLOTRIMETHYLENETRINITRAMINE (RDX)	871.35	+	
60	160	2-HEXANONE	970.35	+	
62	162	CIS-CHLORDANE	959.77	+	
72	164	NAPHTHALENE	902.82	+	+
173	166	ACETONE	692.84	+	
24	172	CYANIDE	1113.09	+	
270	174	O-XYLENE	503.6		
147	178	TRICHLOROFLUOROETHANE	762.34	+	
242	184	CHLOROTOLUENE	572.17	+	
88	189	URANIUM	831.94	+	+
175	191	DIBENZOFURAN	684.92	+	+
229	193	NITRATE	600.16	+	+
135	195	TRIBUTLYTIN	802.03	+	
61	196	TOLUENE	969.44	+	+
81	197	ETHYL BENZENE	847.51	+	+
65	198	ZINC	932.34	+	+
153	200	AMMONIA	748.21	+	
259	201	METHYL-T-BUTYL ETHER	532.07	+	
178	204	ALUMINUM	678.54	+	+
235	206	FORMALDEHYDE	581.24	+	
146	215	PENTACHLOROBENZENE	764.9	+	
98	220	BARIUM	816.92	+	+
187	221	TETRACHLORODIBENZO-P-DIOXIN	629.79	+	
85	222	THIOCYANATE	842.29	+	
262	223	1,2,3,4,6,7,8-HEPTACHLORODIBENZO-P-DIOXIN	519.94	+	
272	223	1,2,3,7,8-PENTACHLORODIBENZO-P-DIOXIN	503.08	+	
10		POLYCYCLIC AROMATIC HYDROCARBONS	1251.5	+	+

FIGURE 7-2

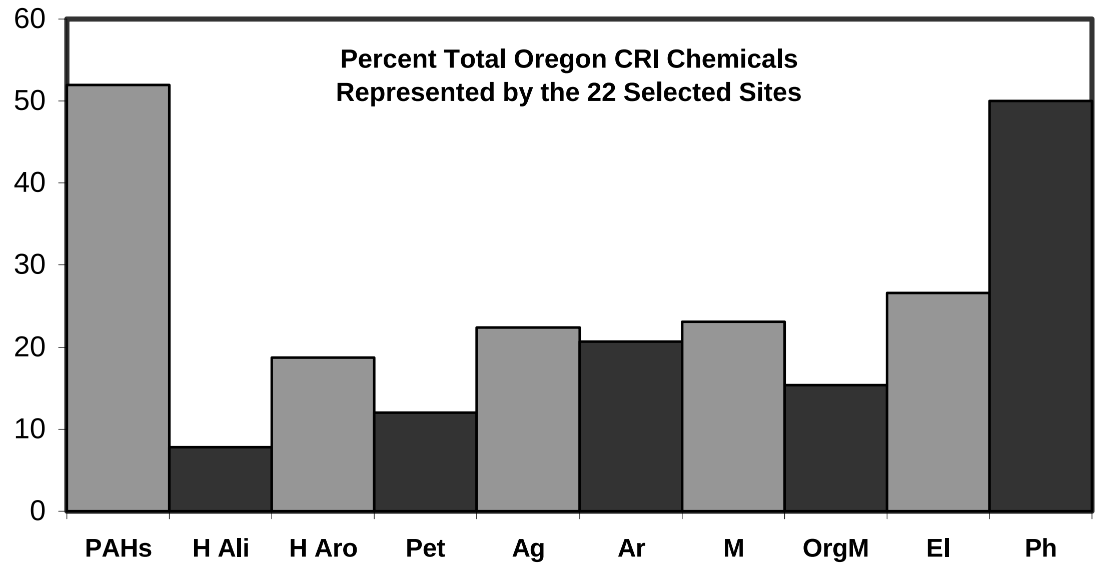


FIGURE 7-3

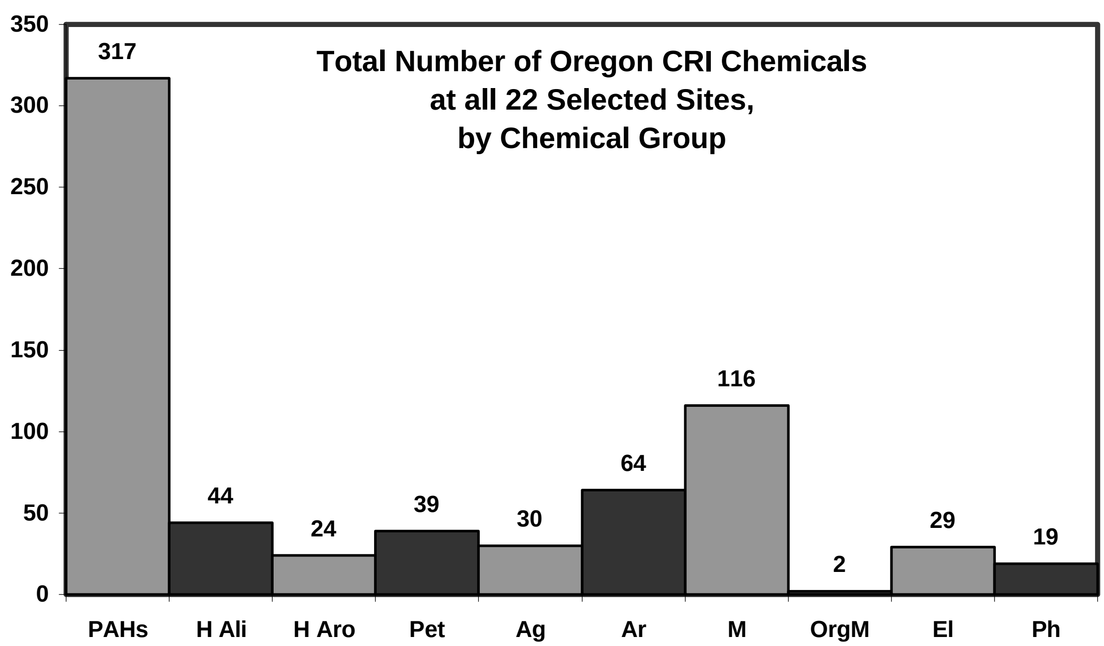
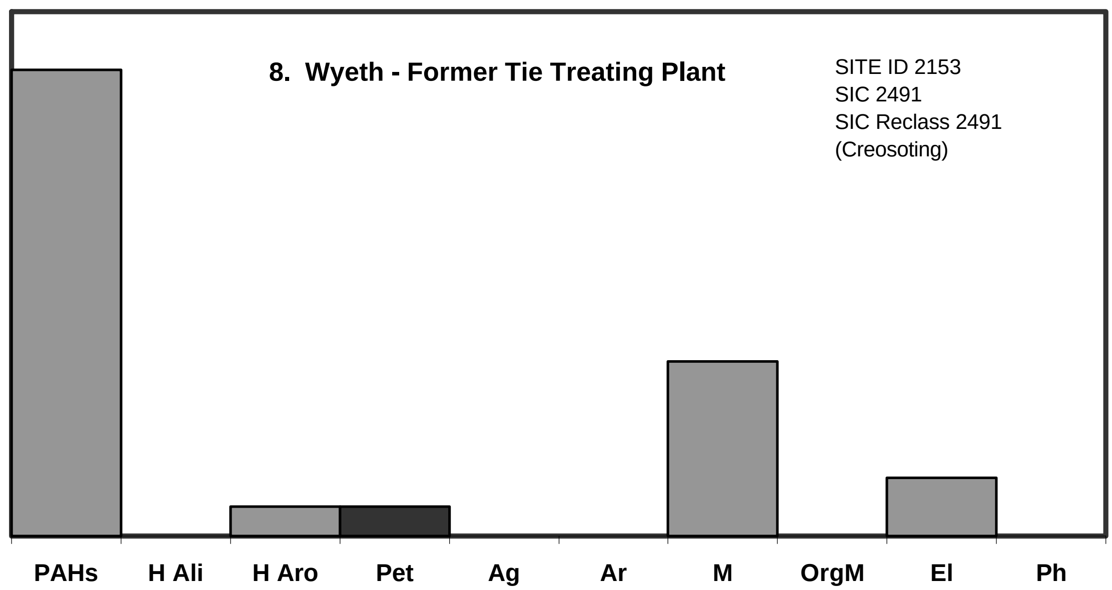
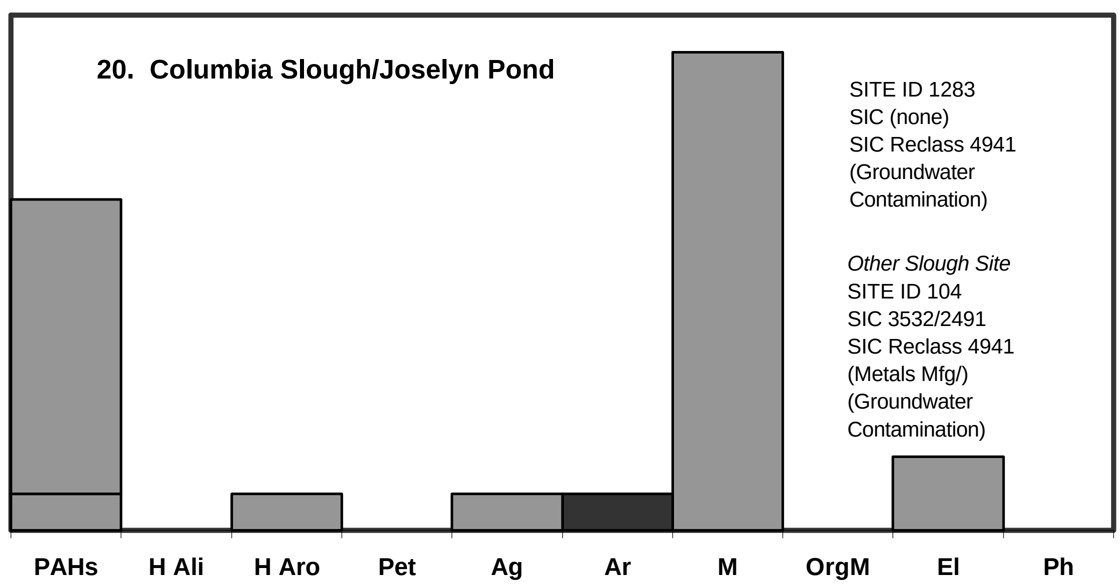


FIGURE 7-4

CHEMICAL PROFILES FOR HIGH RISK CRI SITES IN OREGON





Note: numbers preceding name indicate rank in listing, i.e. 1 = highest risk, 22 = lowest risk.

6 PG CONTINUATION OF FIGURE 7-4