Report on Workshop to Consider DSL Industrial Sector and Functional Use Codes as Indicators of Potential Human Exposure

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Executive Summary

The revised *Canadian Environmental Protection Act* (CEPA 1999) received Royal Assent in September 1999 and established additional responsibilities for the Minister of the Environment and the Minister of Health with respect to the assessment of risks from existing substances, including:

> **73.** (1) The Ministers shall, within seven years from the giving of Royal Assent to this Act, categorize the substances that are on the Domestic Substances List by virtue of section 66, for the purpose of identifying the substances on the List that, in their opinion and on the basis of available information,
> (a) may present, to individuals in Canada, the greatest potential for exposure; or
> (b) are persistent or bioaccumulative in accordance with the regulations, and inherently toxic to human beings or to non-human organisms, as determined by laboratory or other studies.

The Domestic Substances List (DSL) is the basis for determining whether a substance is "new" for the purposes of CEPA. Substances not appearing on the DSL are subject to pre-notification and assessment by the Government of Canada prior to domestic manufacture or importation. Substances appearing on the DSL are "existing substances."

Industrial sector and functional use codes were established by Environment Canada for creation of the DSL. Individual submitters (e.g., companies) were required to use these codes in their submissions. A separate code (i.e., amount code) was used to reflect the amount of a substance imported, manufactured or used by the submitter. Together with the substance identification, this is the only information "available" for *all* of the approximately 23 000 substances on the DSL. Although it is expected that the quantity in commerce information for each DSL substance will also be used in the categorization exercise, the manner in which this information will be used has yet to be determined, and this aspect is not addressed in this report.

A workshop was conducted by staff of the Exposure Assessment Section, Existing Substances Division, Bureau of Environmental Contaminants, within the Safe Environments Programme of the Healthy Environments and Consumer Safety Branch (HECS) of Health Canada. Twenty individuals, the majority of whom are Health Canada staff in the National Capital Region, were invited to participate in a one-day workshop conducted in Ottawa on Wednesday, May 30, 2001. A proposed approach to the categorization of the DSL to satisfy Section 73(1)(a) of the Act was provided as a pre-workshop document.

An overview of the process for developing approaches for categorization of the DSL is included at http://www.hc-sc.gc.ca/hecs-sesc/exsd/index.htm. The "Workshop to Consider DSL Industrial Sector and Functional Use Codes as Indicators of Potential Human Exposure" was an initial step to explore the feasibility of one of several proposed approaches to the categorization of the DSL on the basis of the potential for human exposure. The approach considered is based on the premise that some qualitative indication of the potential human exposure to a specific DSL substance can be inferred by consideration of some or all of the specific use codes reported by companies that were importing, manufacturing or using that substance when the DSL was compiled. A workshop was envisioned as a forum to access desired technical expertise, in order to evaluate whether certain DSL use codes could reasonably be expected to suggest "greatest," "intermediate" or "least" potential for human exposure, on the basis of "expert judgement" when evaluated against predefined criteria. The degrees of consensus concerning the potential for human exposure that might be inferred by each of the industrial sector and functional use codes were assessed by post-workshop analyses of worksheets completed by the participants.

No evidence was identified, prior to the workshop or subsequently, that indicates that the DSL functional use codes and industrial sector codes were originally intended by Environment Canada to record and obtain information relevant to the assessment of human exposure to substances included on the DSL. On this basis, the proposed application of these use codes for categorization of the DSL to identify those substances that may present the greatest potential for human exposure may constitute an application of this information in a manner in which it

was not originally intended.

Nevertheless, the workshop and subsequent analyses were successful in demonstrating that a high degree of consensus could be realized among knowledgeable staff that certain functional use codes or industrial sector codes could reasonably be expected to infer a greater potential for exposure than other codes when evaluated systematically against relevant criteria. However, this high degree of consensus was realized for only a few of the functional use codes and industrial sector codes, and these are identified in this report.

Relative rankings of the potential for human exposure inferred by 49 functional use codes and by 46 industrial sector codes were established through analysis of the completed worksheets by the procedures outlined in the pre-workshop background information. These overall rankings are presented as attachments to this report.

Written comments were solicited from workshop participants using the worksheets provided. These handwritten comments were transcribed and are included as an attachment to this report.

The proposed approach to categorization on the basis of potential for exposure may prove most useful for those DSL substances for which no other information is available with which to assess potential for human exposure.

Introduction and Background Information

Twenty individuals, mainly Health Canada staff in the National Capital Region, were invited to participate in a one-day workshop conducted in Ottawa on Wednesday, May 30, 2001. The workshop was conducted by staff of the Exposure Assessment Section, Existing Substances Division, Bureau of Environmental Contaminants, within the Safe Environments Programme of the Healthy Environments and Consumer Safety Branch (HECS) of Health Canada.

The workshop participants are knowledgeable in chemistry, but are not exclusively involved in exposure assessment activities. An effort was made to include individuals with diverse work experience, to best address the multifaceted nature of human exposures to chemical substances. Participants agreed to act as an "*Ad Hoc* Panel to Consider DSL Industrial Sector and Functional Use Codes as Indicators of Potential Human Exposure." **Attachment 1** is the list of invited participants.

Pre-workshop background information was provided to each of the invited participants concerning the categorization and screening of substances on Canada's Domestic Substances List (DSL) as required by the recently revised *Canadian Environmental Protection Act* (CEPA 1999). A "strawman" proposal outlined in this pre-workshop background information suggests that the DSL use codes and quantity in commerce information *alone* could be used to categorize the substances on the DSL, "for the purpose of identifying the substances on the List" that, on the basis of available information, "may present, to individuals in Canada, the greatest potential for exposure" (i.e., CEPA 73(1)(a)).

The proposed "strawman" approach is based on the premise that some qualitative indication of the potential human exposure to a specific DSL substance can be inferred by consideration of some or all the specific use codes reported by companies that were importing, manufacturing or using that substance when the DSL was compiled. A one-day workshop was envisioned as a forum to access desired technical expertise, in order to evaluate whether certain DSL use codes could reasonably be expected to suggest "greatest," "intermediate" or "least" potential for human exposure, on the basis of "expert judgement" when evaluated against predefined criteria. Specifically, the degrees of consensus concerning the potential for human exposure that might be inferred by each industrial sector and functional use code were to be assessed by post-workshop analyses of worksheets completed by the members of the *Ad Hoc* Panel. The results of these analyses are presented in the following pages.

Attachment 2 is the workshop agenda. The workshop opened with brief presentations concerning the systematic evaluation of "existing substances" by Health Canada and Environment Canada through the processes of categorization of the DSL and screening-level risk assessments. This was followed by a presentation outlining the nature of the multimedia and multi-pathway exposures considered during human risk assessments of existing substances under Health Canada's Priority Substances Assessment Program, i.e.,

- indirect exposure (i.e., following environmental transport and distribution) of the general population to substances present as contaminants in air, water, food and beverages;
- direct human exposure for subpopulations in the vicinity of industrial discharges; and
- exposure of consumers resulting from the use of various products available at the retail level.

The latter presentation was also used to provide some background and introduction to the two sets of criteria proposed (i.e., in the pre-workshop background information) to evaluate the industrial sector and functional use codes, respectively.

The *Ad Hoc* Panel was given the option of accepting the two sets of criteria, revising them or replacing them with other criteria. In both cases, the Panel chose to retain the criteria as originally proposed in the pre-workshop background information to evaluate the industrial sector and functional use codes.

The Domestic Substances List

"The Domestic Substances List (DSL) is the sole basis for determining whether a substance is new for the purposes of CEPA. Substances on the DSL are considered to exist in Canadian commerce and do not require notification. Substances not appearing on the DSL are considered new to Canada and are subject to notification" (Government of Canada, 1993).

There are apparently numerous versions of the DSL. In its simplest form (e.g., as provided to industry as the basis for determining whether a substance is new for the purposes of notification), the DSL includes items 1), 2) and 3) identified below. Environment Canada maintains more comprehensive DSL databases, which include more specific and detailed information (i.e., including confidential business information) from individual submitters. Current understanding is that the version of the DSL to be categorized by Health Canada includes only:

1) the Chemical Abstracts Service (CAS) Registry Number[1];
2) the substance name according to CAS nomenclature rules[2];
3) the molecular formula, when the substance is well defined;
4) the commercial use(s) of the substance, represented by DSL industrial category and functional use codes; and
5) the quantity of substance in Canadian commerce, in the form of quantity codes representing order-of-magnitude ranges of quantities.

The "strawman" approach under consideration involves only items 1), 4) and 5) from those listed above and is based on two assumptions:

- that the information in all DSL records for items 4) and 5) was approximately accurate when recorded in the mid-1980s; and
- that this information adequately reflects current commercial uses and quantities in commerce in Canada.

Item 4) was the focus of the "Workshop to Consider DSL Industrial Sector and Functional Use Codes as Indicators of Potential Human Exposure." It is expected that the quantity in commerce information (i.e., item 5)) for each DSL substance will also be used in the categorization of the DSL; however, the precise manner in which this information will be used has yet to be determined.

The DSL Use Codes

Ninety-eight use codes were established for reporting for the DSL (Environment Canada, 1988). There are three types of use codes: a) special use (codes 00 and 01); b) functional use (codes 02–51); and c) industrial sector (codes 52–98). The two special use codes are 00 for research and development and 01 for site-limited substance (i.e., manufactured within a particular plant site and not distributed, either unaltered or in any mixture or article, for commercial purposes outside that site). If a substance has *only* codes 00 and/or 01, the potential for human exposure that this infers must be low, due to the limited opportunities for human contact. Two of the 98 codes are reserved for miscellaneous uses, not captured by other codes. These are functional use code 51 (for a function other than those listed in codes 02–50) and industrial sector code 98 (for use in an industry other than those specified in codes 52–97). It was proposed that codes 51 and 98 not be used for categorization, due to their non-specific nature. This leaves 95 DSL use codes for further consideration (i.e., 49 functional use codes and 46 industrial sector codes).

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[1] Certain substances, notably polymers and UVCBs, do not have CAS Registry Numbers or molecular formulas.

[2] French language names are according to IUPAC nomenclature rules.

Prior to the workshop, considerable effort was made to learn more about these DSL use codes. Information was sought concerning the origin of these codes, largely in order to understand the original intent in requiring submitters to specify codes for the individual substances that they were reporting. It was felt that if the original intent of these codes was to record information that might be useful in assessing the exposure of human or non-human populations to individual substances, then this would lend support to the proposed use of these codes for identifying those DSL substances with the “greatest potential” for human exposure. On the other hand, if the original intent was for another purpose (e.g., economic analysis), then a valid argument would exist for not trying to infer “potential for exposure” for each of the individual use codes. It was also hoped that there might be definitions or descriptions that might help delineate what specific uses or industrial activities were included in or excluded from any given code. These efforts have been largely unsuccessful in revealing additional useful information, as outlined below.

The DSL use codes were derived by staff at Environment Canada from U.S. Environmental Protection Agency (USEPA) use codes that were available to compile the *Toxic Substances Control Act* (TSCA) inventory. This larger list of codes was reduced following comparison with use codes in the *Environmental Contaminants Act* (i.e., the predecessor to CEPA) and in new chemicals notifications received by Environment Canada (Atkinson, 2001). No written report or background documentation is available from this activity.

No information was identified that indicates that these codes were intended to capture information relevant to exposure of human or non-human populations to individual DSL substances. In fact, information to the contrary exists. DSL use codes were *not* among the parameters used to infer “presence in the Canadian environment” when screening existing substances for inclusion in the second Priority Substances List (Environment Canada, 1995; Koniecki *et al.*, 1997). Whether or not the DSL use codes were originally intended to reflect aspects of exposure, it is clear that these codes have not been used for this purpose in a systematic manner in Canada.

On the other hand, it is evident that similar codes have been or are used to infer or assess exposures in international jurisdictions. Fifty-four codes are assigned to functional categories of substances for notification of new substances in the European Community (van der Poel, 1994). In many cases, examples or inclusions are identified in parentheses following the main functional category entries. This same information appears as “Use Categories” in the EEC-OECD HEDSET (Harmonized Electronic Data Set) for existing chemicals (European Commission, 1996). HEDSET also includes codes for 16 industrial categories and the following “Main Categories” (which were discussed briefly during the workshop):

I Used in closed systems (Note: includes three subcategories)
II Use resulting in inclusion into or onto a matrix
III Non-dispersive use
IV Wide dispersive use

Definitions of the 54 functional categories of substances are available (i.e., pages 580–587 in European Commission, 1996). There is also a cross-listing of the 54 functional categories of substances to 383 ChemUSES functions identified by the USEPA in 1980 (RIVM, VROM and VWS, 1999). This information was considered useful for understanding what might be included in each of the DSL functional use codes. Consequently, several copies of much of this information and additional definitions of functions and uses of chemical substances were made available to workshop participants as background information. In contrast, little useful additional information was identified concerning the DSL industrial sector codes.

Functional use code numbers (i.e., 02–51) precede industrial sector code numbers (i.e., 52–98) in the numeric listing of DSL use codes. However, it was decided to address the industrial sector codes first during the workshop, and this was done during the morning session. The decision was based largely on the expectation that relatively more useful information would result from consideration of the functional use codes. Assigning descriptors first to the industrial sector codes was viewed as somewhat of a training activity, i.e., to familiarize the participants with the worksheets and to allow them to become comfortable with the application of the predefined criteria.

Industrial Sector Codes

Note that the DSL industrial sector codes provide no information concerning the nature or quantities of emissions, releases, discharges, etc., during industrial use of any substance or during any stage in the life cycle of products resulting from the use of the substance. A substance on the DSL may be an intended or an unwanted component of a commercial or consumer product.

The criteria proposed in the pre-workshop background information were based on the assumptions that, in non-workplace environments,[3] human exposure to a DSL substance may occur due to contact with:

1) process emissions and/or effluents (i.e., either directly due to proximity to a source or indirectly following environmental transport and distribution);
2) the substance or its residue in product(s) used or consumed; and/or
3) the substance having entered environmental media following use of the product.

These were described as "contact scenarios." The numerical order of these criteria generally follows the stages of a product life cycle. The Panel was given the option of rejecting or revising these criteria, but it did not do so. Worksheets including these criteria and the list of industrial sector codes were provided. The Panel was instructed to assign the descriptors "low," "medium" or "high" for each of these three contact scenarios, for each of the DSL industrial sector codes.

It was indicated in the pre-workshop background information that the overall degree of potential human exposure would be assessed (i.e., post-workshop) as follows:

- "greatest" potential for human exposure — at least one "high" and one "medium" contact
- "intermediate" potential for human exposure — at least two "medium" contacts (and no "high" contacts)
- "least" potential for human exposure — two or more "low" contacts (and no "high" contacts)

It is recognized that this proposed rating assignment provides many more opportunities for ranking as "greatest" potential (n = 5) than as "intermediate" potential (n = 3) or as "low" potential (n = 2) for human exposure. Consequently, other aspects of the rating of industrial sector codes were investigated in the post-workshop analysis.

The completed worksheets were analysed after the workshop. The analysis involved recording each participant's worksheet entries to a worksheet of an Excel™ workbook. **Attachment 3** is a summary of the overall ranking of the 46 DSL industrial sector codes on the basis of "potential for exposure" that might be inferred, when evaluated as outlined above (i.e., as in the pre-workshop background information). Note that for this analysis, participants' worksheet responses were assumed to be "medium" unless clearly indicated otherwise. For example, when ranges were recorded (i.e., "low–medium" or "medium–high" or "low–high), when the entry was illegible or when there was no entry, a response of "medium" was assumed. The average number of times each descriptor was assigned (i.e., in the post-workshop analysis) among the 46 industrial sector codes was very similar (i.e., "least" = 16.0; "intermediate" = 14.2; and "greatest" = 15.8).

The objective of the workshop was to assess the degree of consensus that might exist that any of the DSL use codes might infer a "greatest" potential for human exposure. However, no definition of "consensus" was established. In **Attachment 3**, the industrial sector codes are ranked by the number of times the descriptor "greatest" was assigned (i.e., as proposed in the pre-workshop background information). The relative proportion that "greatest"

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[3] Human exposures in workplace settings were excluded from consideration due to the high probability that there will always be some workers for whom potential exposure to DSL substances will be high. Also, such exposures are more appropriately addressed under other legislation or jurisdictions.

was assigned for each code (i.e., from a total of 20 possible responses, from the 20 participants) is indicated as a percentage (i.e., proportion of total for “greatest”). These percentages decrease from 80% to 0%. An industrial sector code with a percentage of 80% means that four of five workshop participants would consider that code to infer a “greatest” potential for human exposure. Similarly, if two of three workshop participants considered a code to infer a “greatest” potential for human exposure, the percentage (appearing in **Attachment 3**) would be 66%.

As indicated in **Attachment 3**, there are only six industrial sector codes for which the proportion of the total for “greatest” exceeds 66%. These codes are identified in **Table 1** below. As an alternative ranking procedure, the weights 1, 2 and 3 were arbitrarily assigned to the descriptors “least,” “intermediate” and “greatest,” respectively, and the sums of these weights were calculated for each industrial sector code. The resulting rankings by this procedure are also indicated (i.e., in parentheses) in **Table 1**. Note that the “top six” codes are the same in each case, although differences in the relative rankings are apparent.

Table 1 - Six industrial sector codes for which consensus is high that potential exposure is “greatest”

Relative ranking[a]	Industrial sector code		No. of times descriptor was assigned:			Proportion of total for “greatest”
	no.	description	“least”	“intermediate”	“greatest”	
1 (2)	93	soap and cleaning products	0	4	16	80%
2 (1)	53	agriculture, field crops	1	3	16	80%
3 (3)	60	cosmetics	1	4	15	75%
4 (6)	82	petroleum and natural gas	3	2	15	75%
5 (4)	63	fertilizer	0	6	14	70%
6 (5)	81	pest control products/formulating and manufacture	0	6	14	70%

[a] The relative ranking is according to the proportion of “greatest” descriptor assigned, by the process outlined in the pre-workshop background information. The relative ranking for the complete list of 46 industrial sector codes appears as **Attachment 3**. The rankings indicated in parentheses result if the weights 1, 2 and 3 are assigned to the descriptors “least,” “intermediate” and “greatest,” respectively, and the sums of these weights are calculated for each code.

The six industrial sector codes identified above are examined further in **Table 2** below, from the perspective of the relative contributions of the three contact scenarios established as criteria. The number of low (L), medium (M) and high (H) responses recorded by the 20 participants for each code for each of the three scenarios is indicated. The relative ranking for each code under each scenario (when sorted first by the number of “high” responses, then by the number of “medium” responses) is also indicated in **Table 2**. The relative rankings of all 46 industrial sector codes under each of the contact scenarios are presented in **Attachment 4**.

Table 2 - Rankings by contact scenarios for first six industrial sector codes with “greatest” exposure potential

Relative ranking[a]	Industrial sector code		Rankings and scores of industrial sector codes under three contact scenarios		
	no.	**description**	1) process emissions and/or effluents (i.e., either directly due to proximity to a source or indirectly following environmental transport and distribution)	2) the substance or its residue in product(s) used or consumed	3) the substance having entered environmental media following use of the product
1 (2)	93	soap and cleaning products	ranking = 20th of 46 L = 5, M = 13, H = 2	ranking = 2nd of 46 L = 0, M = 4, H = 16	ranking = 6th of 46 L = 3, M = 8, H = 9
2 (1)	53	agriculture, field crops	ranking = 3rd of 46 L = 6, M = 6, H = 8	ranking = 7th of 46 L = 3, M = 5, H = 12	ranking = 3rd of 46 L = 2, M = 8, H = 10
3 (3)	60	cosmetics	ranking = 45th of 46 L = 14, M = 6, H = 0	**ranking = 1st of 46** L = 0, M = 2, H = 18	ranking = 24th of 46 L = 5, M = 13, H = 2
4 (6)	82	petroleum and natural gas	ranking = 5th of 46 L = 3, M = 10, H = 7	ranking = 8th of 46 L = 6, M = 2, H = 12	ranking = 5th of 46 L = 6, M = 4, H = 10
5 (4)	63	fertilizer	ranking = 18th of 46 L = 5, M = 12, H = 3	ranking = 6th of 46 L = 1, M = 6, H = 13	**ranking = 1st of 46** L = 0, M = 9, H = 11
6 (5)	81	pest control products/ formulating and manufacture	ranking = 26th of 46 L = 10, M = 8, H = 2	ranking = 5th of 46 L = 0, M = 6, H = 14	ranking = 4th of 46 L = 2, M = 8, H = 10

[a] The relative ranking is according to the proportion of “greatest” descriptor assigned, by the process outlined in the pre-workshop background information. The relative ranking for the complete list of 46 industrial sector codes appears as **Attachment 3**. The rankings indicated in parentheses result if the weights 1, 2 and 3 are assigned to the descriptors “least,” “intermediate” and “greatest,” respectively, and the sums of these weights are calculated for each code.

In general, for these six industrial sector codes, the first contact scenario was considered of least importance with respect to “potential for exposure” by the workshop participants. Note that in **Attachment 4**, the two industrial sector codes (90 pulp and paper; 72 mining, metal and non-metal) that ranked highest under the first contact scenario (i.e., contact with process emissions and/or effluents (i.e., either directly due to proximity to a source or indirectly following environmental transport and distribution)) do not appear among the six codes identified in **Tables 1** and **2**. However, as these two industrial sectors have a “history” of environmental contamination in Canada, it is not unexpected that workshop participants assigned a high likelihood for human exposure to process emissions and/or effluents from these sectors.

In contrast, for the six codes identified in **Tables 1** and **2**, the second contact scenario (i.e., contact with the substance or its residue in product(s) used or consumed) was considered much more important by participants. Two of these six codes were ranked first and second by participants when ranked against this criterion.

Similarly, for the six codes identified in **Tables 1** and **2**, the third contact scenario (i.e., contact with the substance having entered environmental media following use of the product) was also considered very important by participants. Five of the six codes identified in **Tables 1** and **2** were in the first six codes of the 46 codes when ranked against this criterion. This includes the first overall ranking against this criterion (i.e., code 63 - fertilizer).

As indicated in **Attachment 3**, for the next six industrial sector codes, the proportion of the total for "greatest" ranges from 55% to 65%. These proportions are considered here to indicate "near" consensus. These next six codes are identified in **Table 3** below. Again, as an alternative ranking procedure, the weights 1, 2 and 3 were arbitrarily assigned to the descriptors "least," "intermediate" and "greatest," respectively, and the sums of these weights were calculated for each industrial sector code. The resulting rankings by this procedure are also indicated (i.e., in parentheses) in **Table 3**. Note that five of these "next six" industrial sector codes are the same in each case, although differences in the relative rankings are again apparent. Whereas code 54 (agriculture, other) ranks as 12th under the procedure outlined in the pre-workshop background information, it ranks as 13th by the alternative procedure involving weighting. Similarly, while code 58 (chlor-alkali) ranks as 13th under the procedure outlined in the pre-workshop background information, it ranks as 12th by the alternative procedure involving weighting.

Table 3 - Six industrial sector codes for which there was near consensus that potential exposure is "greatest"

Relative ranking	Industrial sector code		No. of times descriptor was assigned:			Proportion of total for "greatest"
	no.	description	"least"	"intermediate"	"greatest"	
7 (10)	65	food, feed, and beverage	4	3	13	65%
8 (7)	91	refined petroleum and coal products	0	8	12	60%
9 (8)	97	water and waste treatment	1	7	12	60%
10 (9)	64	forestry/wood products/wood treatment	2	6	12	60%
11 (11)	83	pharmaceuticals	2	7	11	55%
12 (13)	54	agriculture, other	5	4	11	55%

These "next six" industrial sector codes are examined further in **Table 4**, from the perspective of the relative contributions of the three contact scenarios established as criteria. The number of low (L), medium (M) and high (H) responses recorded by the 20 participants for each code for each of the three scenarios is indicated. The relative ranking for each code under each scenario (when sorted first by the number of "high" responses, then by the number of "medium" responses) is also indicated in **Table 4**. As previously noted, the relative rankings of all 46 industrial sector codes under each of the contact scenarios are presented in **Attachment 4**.

For these "next six" industrial sector codes, the first contact scenario (i.e., contact with process emissions and/or effluents (i.e., either directly due to proximity to a source or indirectly following environmental transport and distribution)) was also considered of relatively lesser importance with respect to "potential for exposure" by the workshop participants. Among these "next six" codes, industrial sector code 91 (refined petroleum and coal products) was the highest ranking (i.e., 4th) under this scenario.

The second contact scenario (i.e., contact with the substance or its residue in product(s) used or consumed) was considered by participants to be more important with respect to "potential for exposure." The third and fourth highest-ranking industrial sector codes for this contact scenario are included among these "next six" industrial sector codes.

The third contact scenario (i.e., contact with the substance having entered environmental media following use of the product) was considered by participants to be of intermediate importance with respect to "potential for exposure". The second, seventh, eighth and ninth highest ranking of the 46 industrial sector codes for this contact scenario are included among these "next six" industrial sector codes.

As noted previously, the industrial sector code that was ranked highest under the first contact scenario (i.e., contact with process emissions and/or effluents (i.e., either directly due to proximity to a source or indirectly following environmental transport and distribution)) does not appear in **Table 2** or **4**. This is code 90 - pulp and paper. Workshop particpants recorded 10 “medium” responses, 10 “high” responses and no “low” responses for this code when evaluated under the first contact scenario. However, as indicated in **Attachment 3**, the overall relative ranking for code 90 is 18th (or 16th using the alternative weighting procedure) among the 46 codes, due to lower rankings when evaluated against the remaining two contact scenarios.

Table 4 - Rankings by contact scenarios for six industrial sector codes with “near” consensus

Relative ranking[a]	Industrial sector code		Rankings and scores of industrial sector codes under three contact scenarios		
	no.	**description**	1) process emissions and/or effluents (i.e., either directly due to proximity to a source or indirectly following environmental transport and distribution)	2) the substance or its residue in product(s) used or consumed	3) the substance having entered environmental media following use of the product
7 (10)	65	food, feed, and beverage	ranking = 37th of 46 L = 14, M = 5, H = 1	ranking = 3rd of 46 L = 3, M = 1, H = 16	ranking = 17th of 46 L = 9, M = 7, H = 4
8 (7)	91	refined petroleum and coal products	ranking = 4th of 46 L = 1, M = 12, H = 7	ranking = 14th of 46 L = 2, M = 11, H = 7	ranking = 7th of 46 L = 4, M = 8, H = 8
9 (8)	97	water and waste treatment	ranking = 12th of 46 L = 5, M = 10, H = 5	ranking = 10th of 46 L = 3, M = 7, H = 10	ranking = 2nd of 46 L = 2, M = 7, H = 11
10 (9)	64	forestry/wood products/wood treatment	ranking = 11th of 46 L = 5, M = 10, H = 5	ranking = 11th of 46 L = 2, M = 8, H = 10	ranking = 9th of 46 L = 6, M = 9, H = 5
11 (11)	83	pharmaceuticals	ranking = 39th of 46 L = 14, M = 5, H = 1	ranking = 4th of 46 L = 0, M = 5, H = 15	ranking = 16th of 46 L = 8, M = 8, H = 4
12 (13)	54	agriculture, other	ranking = 17th of 46 L = 9, M = 7, H = 4	ranking = 12th of 46 L = 4, M = 8, H = 8	ranking = 8th of 46 L = 5, M = 10, H = 5

[a] The relative ranking is according to the proportion of “greatest” descriptor assigned, by the process outlined in the pre-workshop background information. The relative ranking for the complete list of 46 industrial sector codes appears as **Attachment 3**. The rankings indicated in parentheses result if the weights 1, 2 and 3 are assigned to the descriptors “least,” “intermediate” and “greatest,” respectively, and the sums of these weights are calculated for each code.

There was no consensus among workshop participants that the remaining 34 industrial sector codes listed in **Attachment 3** infer a “greatest” potential for human exposure when evaluated against the criteria established. It is notable that when ranking by the proportion of “greatest” descriptors assigned (expressed as percentages), the top 30% (i.e., 70–100%) captures only six codes (i.e., 13% of the 46 codes), whereas the same 30% range (i.e., 0–30%) captures 27 (or 59%) of the 46 codes in **Attachment 3**.

Nine of the 12 industrial sector codes identified in **Tables 1–4** as presenting the “greatest” potential for human exposure had been previously identified in the pre-workshop background information as presenting the “greatest” potential. The remaining three of these 12 industrial sector codes had been identified in the pre-workshop background information as presenting an “intermediate” potential. These codes were 53 (agriculture, field crops), 54 (agriculture, other) and 91 (refined petroleum and coal products). The greatest difference with the pre-workshop assignment of descriptors was for code 53 (agriculture, field crops), which was ranked second overall as inferring "greatest" potential for exposure in the post-workshop analysis of participants' worksheets.

Functional Use Codes

Note that the DSL functional use codes provide no information concerning the nature or quantities of emissions, releases, discharges, etc., during industrial use of a substance or during any stage in the life cycle of products resulting from the use of the substance. For example, the fact that the functional use code indicates that a substance is used as a monomer (i.e., code 28) provides no information regarding the release of the monomer during production of a polymer or its subsequent release from a manufactured article incorporating that polymer. Therefore, the proposed categorization is based on attempting to assess the degree of potential human exposure to whatever is the result of the particular functional use category. For example, when the result of a functional use category is a manufactured article or consumer product, the likelihood is greater that humans will be exposed to the result of the use category, and by inference to the substance, if it is likely to still remain intact within the manufactured article or consumer product.

The objective set for the workshop participants was to separate the 49 functional use codes into three classes representing the "greatest," an "intermediate" and the "least" potential for human exposure. Note that attention was directed to two aspects of the potential for human exposure:

- For the "*fate of substance aspect,*" workshop participants were instructed to speculate as to what happens to a substance having a particular functional use, considering, for example, the possibility that the substance may be partially or totally reacted, consumed, tightly bound or otherwise altered by that use.

- For the "*human contact parameter aspect,*" workshop participants were instructed to speculate as to the frequency and/or magnitude of direct human contact (i.e., in non-workplace environments) with the substance itself or, more frequently, with media containing the substance (i.e., with contact media, as previously described).

Table 5 - Criteria proposed to and accepted by workshop participants for DSL functional use codes

Potential for human exposure	Aspect of potential exposure	Criteria for inclusion based on functional use codes
"greatest"	fate of substance	a) high certainty that a substance used in this manner will be present as or in a consumer product related to the functional use category; *and*
	human contact parameter	b) greater than 10% of individuals are likely to have contact with consumer products related to the functional use category on any given day.
"intermediate"	fate of substance	a) functional use is more related to a process occurring during manufacture, production or formulation; *and*
	human contact parameter	b) a substance used in this manner may remain in a product to which humans may be exposed.
"least"	fate of substance	a) substance related to the functional use category is likely to be altered or consumed during use; *or*
	human contact parameter	b) substance related to the functional use category is likely to be used only in closed systems or restricted areas (i.e., workplaces).

The six subjective criteria proposed to separate the functional use codes into these three classes are identified in **Table 5**. These criteria had been included in the pre-workshop background information. Participants were given the option of rejecting or revising the proposed criteria, but did not do so. Worksheets including these criteria and the list of functional use codes were provided. Participants were instructed that both criteria must be satisfied for the “greatest” and “intermediate” classes (i.e., if only one criterion was satisfied, then the functional use code was assigned to the nearest lower class).

Note that it was not intended that participants speculate as to the availability (e.g., bioavailability, “extractability”) of a substance present in products or fomulations on the basis of its functional use code(s), since this “availability” is thought to be more dependent on the nature of the substance and the matrix (i.e., specific product or formulation) than on the nature of the specific functional use of a substance.

The completed worksheets were analysed after the workshop. The analysis involved recording each participant’s worksheet entries to a worksheet of an Excel™ workbook. The number of times each functional code was assigned each descriptor (i.e., “least,” “intermediate” or “greatest”) was counted. The theoretical maximum was 20, if there were no “least” or “intermediate” descriptors recorded. The proportion of this total representing the number of times the descriptor “greatest” was assigned was expressed as a percentage. The functional use codes were then sorted in descending order by the number of “greatest” descriptors recorded. The number of “intermediate” descriptors recorded was used for additional sorting when required. The overall ranking of the 49 functional use codes on this basis is presented in **Attachment 5**. There was a moderate to high degree of consensus among workshop participants (i.e., 65– 95%) that the eight functional use codes identified in **Table 6** should infer a “greatest” potential for human exposure.

Table 6 - Functional use codes for which there was the highest consensus that potential exposure is “greatest”

Relative ranking	Functional use code		Number of times descriptor was used:			Proportion of total for “greatest”
	no.	description	“least”	“intermediate”	“greatest”	
1	22	fragrance/perfume/deodourizer/flavouring agent	0	1	19	95%
2	31	pesticide/herbicide/biocide/disinfectant/ repellant/attractant	0	3	17	85%
3	23	fuel/fuel additive	0	4	16	80%
4	39	preservative	0	4	16	80%
5	44	solvent/carrier	0	4	16	80%
6	46	surfactant - detergent/emulsifier/wetting agent/dispersant	0	5	15	75%
7	13	colourant - pigment/stain/dye/ink	0	6	14	70%
8	30	paint/coating additive	1	6	13	65%

As an alternative to ranking on the basis of the number of “greatest” responses recorded by workshop participants, a weighting similar to that outlined previously for the industrial sector codes was applied. The weights 1, 2 and 3 were arbitrarily assigned to the descriptors “least,” “intermediate” and “greatest,” respectively, and the sums of these weights were calculated for each functional use code. The ranking of these first eight functional use codes was unchanged from that presented in **Table 6** when this alternative procedure was applied.

The next eight use codes in the overall ranking of the 49 functional use codes appearing in **Attachment 5** are identified in **Table 7**.

Table 7 - Functional use codes for which there was no clear consensus that potential exposure is "greatest"

Relative ranking	Functional use code		Number of times descriptor was used:			Proportion of total for "greatest"
	no.	description	"least"	"intermediate"	"greatest"	
9	16	fertilizer	1	9	10	50%
10	04	adhesive/binder/sealant/filler	2	8	10	50%
11	21	formulation component	3	8	9	45%
12	06	antifreeze/coolant/deicer	2	10	8	40%
13	50	water or waste treatment chemical	3	9	8	40%
14	27	lubricating agent/lubricant additive/mould release agent	4	8	8	40%
15	18	flame retardant/fire extinguishing agent	6	6	8	40%
16	32	photosensitive agent - fluorescent agent/ brightener/UV absorber	7	5	8	40%

Once again, the weights 1, 2 and 3 were arbitrarily assigned to the descriptors "least," "intermediate" and "greatest," respectively, and the sums of these weights were calculated for each functional use code. The ranking of these first seven of eight functional use codes was unchanged from that presented in **Table 7** (i.e., ranks 9 through 15 overall) when this alternative procedure was applied. Some changes in rank order were apparent following the 15th ranked code when the alternative ranking procedure was applied, as indicated below. However, by the 16th overall ranking, the proportion of the total number of times the descriptor "greatest" was recorded by participants was only 40%, indicating little consensus that these codes infer a "great" potential for human exposure.

	ranking by no. of "greatest"	ranking by weighted sums
32 photosensitive agent - fluorescent agent/brightener/UV absorber	16th	17th
33 plasticizer	17th	18th
38 propellant/blowing agent	18th	19th
17 finishing agent	19th	16th

The DSL functional use codes identified in **Tables 6** and **7** account for 15 of the 22 codes identified in the pre-workshop background information as inferring a "greatest" potential for exposure. The 16th code identified in these tables is functional use code 27 (lubricating agent/lubricant additive/mould release agent), which was identified as inferring an "intermediate" potential for exposure in the pre-workshop background information.

The relative rankings of the remaining six of 22 codes identified in the pre-workshop background information as inferring a "greatest" potential for exposure are indicated in **Table 8**. Note that codes 33 through 36 appear in this group. These functional use codes refer to components of plastics and polymers. Workshop participants viewed these codes as inferring more of an "intermediate" potential for exposure. In contrast, the relative rankings for functional use code 37 (polymer, crosslinking agent) were much lower (i.e., 40th of 49 overall; 39th of 49 overall by the alternative procedure). The large number of "least" descriptors (i.e., 14 of a possible 20) recorded for code 37 (polymer, crosslinking agent) suggests that participants believe a substance having this code to be "altered or consumed during use" (i.e., recall criteria from **Table 5**), which was less frequently the case for the polymer-related codes 33 through 36.

Table 8 - Functional use codes also identified pre-workshop as inferring “greatest” potential for exposure

Relative ranking[a]	Functional use code		Number of times descriptor was used:			Proportion of total for “greatest”
	no.	description	“least”	“intermediate”	“greatest”	
17 (18)	33	plasticizer	6	7	7	35%
18 (19)	38	propellant/blowing agent	6	7	7	35%
19 (16)	17	finishing agent	4	10	6	30%
20 (20)	35	polymer, component of an article	5	9	6	30%
26 (24)	34	polymer additive	7	11	2	10%
31 (25)	36	polymer, component of a formulation	6	13	1	5%

[a] The relative ranking is by the number of times the descriptor “greatest” was assigned to a code by workshop participants. The numbers appearing in parentheses are the rankings when the alternative procedure involving sums of weighted codes is applied, as discussed further in the accompanying text.

Comments from Workshop Participants

Written comments were solicited from workshop participants concerning the use codes and their proposed application to the categorization of the DSL. Ample space was provided on the two worksheets for this purpose. Most participants opted to provide written comments, and both general and more specific comments and suggestions were received. These handwritten comments are transcribed in **Attachment 6** and are discussed briefly below.

Workshop participants were of the view that the greatest practical impediment to the proposed approach to categorization is that many of the use code descriptions are too vague, too general or too ambiguous to be used with confidence in decision-making processes. There were numerous references to seemingly overlapping code descriptions. This contributes to uncertainty when speculating as to which of the limited list of DSL industrial sector or functional use categories an industrial subsector or a specific functional use might belong. The proposed approach is less consistent and less scientifically defensible if the exposure assessors categorizing the DSL do not share a common understanding with the original submitters from industry regarding the inclusions and exclusions within each code description.

It was also felt that the ability to associate specific quantities in use with each specific functional use code and industrial sector code listed for a substance would greatly enhance the utility of approaches to DSL categorization based on these DSL use codes. However, current understanding is that it is not (and will not be) possible to accurately apportion quantities to the various DSL use codes listed for any given substance, due to the nature of the reporting requirements and other database limitations.

Key physical-chemical properties of substances were considered by many participants to be more important parameters in determining the potential for exposure than the information captured by the DSL use codes.

Concern was expressed that, due to the criteria that had been established, the potential exposure to substances present in consumer products would overwhelm the categorization process if the proposed approach is used, and that human exposure to a DSL substance only as a result of contamination of the natural environment would never be among the “greatest” exposures to be further investigated in the screening-level exposure assessment phase.

Many workshop participants felt strongly that some aspect(s) of the toxicity of substances would ultimately be necessary in the approach(es) ultimately adopted for categorization of the DSL on the basis of potential for exposure.

Conclusions and Recommendations

1. No evidence was identified that indicates that the DSL functional use codes and industrial sector codes were originally intended by Environment Canada to record and obtain information relevant to the assessment of human exposure to substances included on the DSL. On this basis, the proposed application of these use codes for categorization of the DSL to identify those substances that may present the “greatest potential” for human exposure may constitute an application of this information in a manner in which it was not originally intended. The DSL functional use codes and industrial sector codes do not appear to be the “available information” identified in CEPA 73(1)(a) as the basis for the required categorization of the DSL by Health Canada, which was the premise on which the proposed approach (i.e., strawman #1) was based.

2. The workshop and subsequent analyses were successful in demonstrating that a high degree of consensus could be realized among knowledgeable staff that certain functional use codes or industrial sector codes could reasonably be expected to infer a “greater potential” for exposure than other codes when evaluated systematically against relevant criteria. However, a high degree of consensus was realized for only a few of the functional use codes and industrial sector codes.

3. There was considerably more consensus among workshop participants that relatively larger numbers of the DSL use codes infer little potential for human exposure. In the absence of any other information for categorization purposes, consideration should be given to inferring that the potential for human exposure will not be great for substances having only these codes.

4. Relative rankings of the potential for human exposure inferred by 49 functional use codes and by 46 industrial sector codes were established through analysis of the completed worksheets by the procedures outlined in the pre-workshop background information. Alternative ranking procedures were also investigated for each set of codes and resulted in some differences in the rank order for some codes, but the same subsets of codes (i.e., for which a high degree of consensus exists that a “greater potential” for exposure is inferred) were identified following application of the different procedures.

5. There does not appear to be good cause at present to abandon completely the proposed approach of applying the DSL use code information in a categorization scheme for potential for human exposure, as this may prove useful and/or necessary for substances for which no “exposure information” is available.

6. Since workshop participants were generally of the view that many of the use code descriptions are too vague, too general or too ambiguous, additional efforts are recommended to provide descriptions and definitions, to identify inclusions and exclusions and to cross-reference lists of information, in order that this information can be used with greater confidence in decision-making processes.

7. Although workshop participants did not opt to reject or revise the criteria communicated to them in the pre-workshop background information, some suggestions in this regard were received following application of the criteria for completion of the worksheets, and these could be used to revise and improve some of the criteria.

8. Generally, workshop participants reported that application of the criteria established and completion of the worksheets were more straightforward in the case of functional use codes than for industrial sector codes.

However, the post-workshop analysis of participants' worksheets seemed to provide more insight and "richer" information for the industrial sector codes than for the functional use codes. This appears to be a consequence of the nature of the criteria and the manner in which they were to be applied. The information from the industrial sector code worksheets could be analysed at two levels — the "low," "medium" and "high" descriptors assigned by the workshop participants, and the "least," "intermediate" and "greatest" descriptors assigned in the post-workshop analysis. In contrast, while there were two aspects to be considered within each of the criteria to be applied for the functional use codes, only a single response per code was required from the participants. Consequently, fewer options existed when analysing the completed worksheets. It may be useful to revise the criteria established for the functional use codes based on the knowledge and insight gained from the workshop.

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Attachment 1

List of Invited Participants

Invited participant	Organizational information
Ralph Boardman	Hazardous Materials Information Review Commission, 200 Kent Street, Suite 9000, Ottawa.
Gord Boulton	Food Additives and Contaminants Section, Health Products and Foods Branch, Health Canada, Tunney's Pasture, Ottawa.
Richard Carrier	Water Quality and Microbiology Division, Bureau of Environmental Contaminants, HECS, Health Canada, 123 Slater St., Ottawa.
Ed Doyle	New Substances Assessment and Control Bureau, Product Safety Programme, HECS, Health Canada, 123 Slater St., Ottawa.
Rick Farmer	Occupational Health and Safety Agency, HECS, Health Canada, Tunney's Pasture, Ottawa.
Doug Green	Bureau of Environmental Contaminants, HECS, Health Canada, Tunney's Pasture, Ottawa.
Dave Kane	Toxic Substances Research Initiative, Health Impacts Bureau, Safe Environments Programme, HECS, Health Canada, Tunney's Pasture, Ottawa.
Michelle Lee	Chemicals 1 Section, New Substances Assessment and Control Bureau, Product Safety Programme, HECS, Health Canada, 123 Slater St., Ottawa.
Stephen MacDonald	Toxic Substance Management Division, Bureau of Environmental Contaminants, HECS, Health Canada, Tunney's Pasture, Ottawa.
Kristin Macey	Health Evaluation Division, Pest Management Regulatory Agency, 2250 Riverside Drive, Ottawa.
Luc Maheux	Central Region, Occupational Health and Safety Agency, HECS, Health Canada, 171 Slater St., Ottawa.
Ken Mancuso	Risk Management Framework Implementation Section, Toxic Substance Management Division, Bureau of Environmental Contaminants, HECS, Health Canada, Tunney's Pasture, Ottawa.
Christine Norman	Occupational Exposure Assessment Section, Health Evaluation Division, Pest Management Regulatory Agency, 2250 Riverside Drive, Ottawa.
Yves Parent	Food Packaging Material and Incidental Section, Health Products and Foods Branch, Health Canada, Tunney's Pasture, Ottawa.
Darren Porter	New Substances Division, Commercial Chemicals Evaluation Unit, Environment Canada, Place Vincent Massey, Hull.
Baily Seshagiri	Technical Services Unit, Labour Branch, Human Resources Development Canada, Phase II, Place du Portage, Hull.
Lorraine Tetreault	Chemicals 2 Section, New Substances Assessment and Control Bureau, Product Safety Programme, HECS, Health Canada, 123 Slater St., Ottawa.
Jonathan Tigner	New Substances Division, Commercial Chemicals Evaluation Unit, Environment Canada, Place Vincent Massey, Hull.
Graham White	Chemicals 1 Section, New Substances Assessment and Control Bureau, Product Safety Programme, HECS, Health Canada, 123 Slater St., Ottawa.
Jiping Zhu	Chemistry Research Division, Bureau of Environmental Health Sciences, HECS, Health Canada, Tunney's Pasture, Ottawa.

Attachment 2

Workshop Agenda

Date: Wednesday May 30, 2001

Location: Room 0115C, Brooke Claxton Building, Tunney's Pasture, Ottawa

08:30 *Informal meeting (juice, coffee, pastries, etc.)*

09:00 Introduction of participants (affiliation, expertise)
09:10 Background to DSL categorization and screening activities at HC and EC

09:30 Assessment of human exposure in Health Canada's Existing Substances program
09:40 Release fractions - "main category" approach in European Union
09:50 Specific CEPA 1999 revisions relevant to the DSL categorization

10:00 Quantity, industrial sector and functional use codes established for DSL reporting
10:10 Review of "strawman" proposal (i.e., provided as pre-workshop information)

10:15 *Break and informal discussions (juice, coffee, pastries, etc.)*

10:30 Industrial sector codes as indicators of potential for direct/indirect environmental exposures
10:45 Introduction, discussion, revision of proposed criteria (i.e., provided pre-workshop)

11:00 Consensus on criteria to be applied to industrial sector codes
11:15 Application of criteria to industrial sector codes by workshop participants

12:00 *Lunch break (lunch will be provided to workshop participants)*

13:00 Nature of information provided by functional use codes
13:05 Other listings of end uses/applications of products
13:10 Functional use codes as indicators of potential for product-related exposures
13:15 Introduction, discussion, revision of proposed criteria (i.e., provided pre-workshop)

13:30 Consensus on criteria to be applied to functional use codes
13:45 Application of criteria to functional use codes by workshop participants

14:30 *Break and informal discussions (soft drinks, juice, coffee, etc.)*

15:00 Insights gained, suggestions, comments, questions
15:15 Identification of other resources (e.g., information sources, specific expertise, other programs)
15:30 Follow-up to workshop activities
15:45 Thanking participants and end of workshop

Attachment 3

DSL Industrial Sector Codes Ranked by Number of "Greatest" Descriptors Assigned

Relative ranking	Industrial sector code		No. of times descriptor was assigned:			Proportion of total for "greatest"
	no.	description	"least"	"intermediate"	"greatest"	
1	93	soap and cleaning products	0	4	16	80%
2	53	agriculture, field crops	1	3	16	80%
3	60	cosmetics	1	4	15	75%
4	82	petroleum and natural gas	3	2	15	75%
5	63	fertilizer	0	6	14	70%
6	81	pest control products/ formulating and manufacture	0	6	14	70%
7	65	food, feed, and beverage	4	3	13	65%
8	91	refined petroleum and coal products	0	8	12	60%
9	97	water and waste treatment	1	7	12	60%
10	64	forestry/wood products/wood treatment	2	6	12	60%
11	83	pharmaceuticals	2	7	11	55%
12	54	agriculture, other	5	4	11	55%
13	58	chlor-alkali	1	9	10	50%
14	96	transportation	6	4	10	50%
15	80	paint and coating	3	8	9	45%
16	68	inorganic chemicals	4	7	9	45%
17	90	pulp and paper	4	7	9	45%
18	67	industrial gas production	8	3	9	45%
19	66	health and veterinary	7	5	8	40%
20	59	construction materials	5	9	6	30%
21	72	mining, metal and non-metal	5	9	6	30%
22	92	rubber products	6	8	6	30%
23	56	automotive, aircraft and watercraft	11	3	6	30%
24	89	printing and publishing	11	3	6	30%

Relative ranking	Industrial sector code		No. of times descriptor was assigned:			Proportion of total for "greatest"
	no.	description	"least"	"intermediate"	"greatest"	
25	76	organic chemicals, industrial	3	12	5	25%
26	78	organometallic chemicals	8	7	5	25%
27	95	textile, product	10	5	5	25%
28	57	biotechnology	11	4	5	25%
29	70	leather/tanning	4	12	4	20%
30	85	pigment, dye and printing ink	6	10	4	20%
31	86	plastics	12	4	4	20%
32	77	organic chemicals, speciality	7	10	3	15%
33	79	packaging	10	7	3	15%
34	87	plastic and synthetic resin	10	7	3	15%
35	88	plating and surface finishing	10	7	3	15%
36	94	textile, primary manufacture	12	5	3	15%
37	55	article manufacture	13	4	3	15%
38	84	photographic/photocopier	14	3	3	15%
39	71	metallurgical	9	9	2	10%
40	62	explosive materials	11	7	2	10%
41	52	adhesive and sealant production	12	6	2	10%
42	74	non-metallic mineral products, ceramic and glass	12	7	1	5%
43	61	electrical or electronic products	17	2	1	5%
44	69	magnetic tape manufacture	18	1	1	5%
45	75	non-metallic mineral products, other	10	10	0	0%
46	73	non-metallic mineral products, abrasive	11	9	0	0%

Attachment 4

Rankings of DSL Industrial Sector Codes Under the Three Contact Scenarios

In non-workplace environments, human exposure to a DSL substance may occur due to contact with:	
Scenario 1	process emissions and/or effluents (i.e., either directly due to proximity to a source or indirectly following environmental transport and distribution)

For each industrial sector code, rank the likelihood (i.e., low, medium, high) for human exposure for the contact scenario identified above.

Relative ranking	Industrial sector code		No. of times descriptor was assigned under scenario:		
	no.	description	"low"	"medium"	"high"
1	90	pulp and paper	0	10	10
2	72	mining, metal and non-metal	1	9	10
3	53	agriculture, field crops	6	6	8
4	91	refined petroleum and coal products	1	12	7
5	82	petroleum and natural gas	3	10	7
6	96	transportation	6	7	7
7	58	chlor-alkali	5	9	6
8	67	industrial gas production	5	9	6
9	76	organic chemicals, industrial	2	13	5
10	70	leather/tanning	4	11	5
11	64	forestry/wood products/wood treatment	5	10	5
12	97	water and waste treatment	5	10	5
13	78	organometallic chemicals	7	8	5
14	71	metallurgical	6	10	4
15	88	plating and surface finishing	6	10	4
16	68	inorganic chemicals	8	8	4
17	54	agriculture, other	9	7	4
18	63	fertilizer	5	12	3
19	77	organic chemicals, speciality	6	11	3
20	93	soap and cleaning products	5	13	2
21	80	paint and coating	6	12	2

Relative ranking	Industrial sector code		No. of times descriptor was assigned under scenario:		
	no.	description	"low"	"medium"	"high"
22	94	textile, primary manufacture	6	12	2
23	59	construction materials	9	9	2
24	89	printing and publishing	9	9	2
25	55	article manufacture	10	8	2
26	81	pest control products/formulating and manufacture	10	8	2
27	62	explosive materials	13	5	2
28	75	non-metallic mineral products, other	8	11	1
29	87	plastic and synthetic resin	8	11	1
30	73	non-metallic mineral products, abrasive	9	10	1
31	86	plastics	9	10	1
32	56	automotive, aircraft and watercraft	11	8	1
33	74	non-metallic mineral products, ceramic and glass	11	8	1
34	85	pigment, dye and printing ink	11	8	1
35	84	photographic/photocopier	13	6	1
36	52	adhesive and sealant production	14	5	1
37	65	food, feed, and beverage	14	5	1
38	66	health and veterinary	14	5	1
39	83	pharmaceuticals	14	5	1
40	69	magnetic tape manufacture	15	4	1
41	92	rubber products	6	14	0
42	79	packaging	11	9	0
43	95	textile, product	12	8	0
44	57	biotechnology	14	6	0
45	60	cosmetics	14	6	0
46	61	electrical or electronic products	16	4	0

In non-workplace environments, human exposure to a DSL substance may occur due to contact with:	
Scenario 2	the substance or its residue in product(s) used or consumed

For each industrial sector code, rank the likelihood (i.e., low, medium, high) for human exposure for the contact scenario identified above.

Relative ranking	**Industrial sector code**		**No. of times descriptor was assigned under scenario:**		
	no.	**description**	**“low”**	**“medium”**	**“high”**
1	60	cosmetics	0	2	18
2	93	soap and cleaning products	0	4	16
3	65	food, feed, and beverage	3	1	16
4	83	pharmaceuticals	0	5	15
5	81	pest control products/formulating and manufacture	0	6	14
6	63	fertilizer	1	6	13
7	53	agriculture, field crops	3	5	12
8	82	petroleum and natural gas	6	2	12
9	66	health and veterinary	5	4	11
10	97	water and waste treatment	3	7	10
11	64	forestry/wood products/wood treatment	2	10	8
12	54	agriculture, other	4	8	8
13	80	paint and coating	2	11	7
14	91	refined petroleum and coal products	2	11	7
15	95	textile, product	8	5	7
16	58	chlor-alkali	7	7	6
17	96	transportation	7	7	6
18	89	printing and publishing	10	4	6
19	57	biotechnology	6	9	5
20	68	inorganic chemicals	6	9	5
21	90	pulp and paper	10	5	5
22	85	pigment, dye and printing ink	3	13	4
23	92	rubber products	10	6	4
24	86	plastics	14	2	4

Relative ranking	Industrial sector code		No. of times descriptor was assigned under scenario:		
	no.	description	"low"	"medium"	"high"
25	52	adhesive and sealant production	2	15	3
26	59	construction materials	3	14	3
27	76	organic chemicals, industrial	8	9	3
28	67	industrial gas production	11	6	3
29	84	photographic/photocopier	11	6	3
30	87	plastic and synthetic resin	11	6	3
31	56	automotive, aircraft and watercraft	12	5	3
32	94	textile, primary manufacture	12	5	3
33	70	leather/tanning	8	10	2
34	55	article manufacture	9	9	2
35	79	packaging	9	9	2
36	78	organometallic chemicals	12	6	2
37	72	mining, metal and non-metal	14	4	2
38	88	plating and surface finishing	14	4	2
39	77	organic chemicals, speciality	8	11	1
40	62	explosive materials	14	5	1
41	74	non-metallic mineral products, ceramic and glass	14	5	1
42	61	electrical or electronic products	16	3	1
43	75	non-metallic mineral products, other	12	8	0
44	73	non-metallic mineral products, abrasive	13	7	0
45	71	metallurgical	16	4	0
46	69	magnetic tape manufacture	18	2	0

In non-workplace environments, human exposure to a DSL substance may occur due to contact with:	
Scenario 3	the substance having entered environmental media following use and/or disposal of the product

For each industrial sector code, rank the likelihood (i.e., low, medium, high) for human exposure for the contact scenario identified above.

Relative ranking	Industrial sector code		No. of times descriptor was assigned under scenario:		
	no.	description	"low"	"medium"	"high"
1	63	fertilizer	0	9	11
2	97	water and waste treatment	2	7	11
3	53	agriculture, field crops	2	8	10
4	81	pest control products/formulating and manufacture	2	8	10
5	82	petroleum and natural gas	6	4	10
6	93	soap and cleaning products	3	8	9
7	91	refined petroleum and coal products	4	8	8
8	54	agriculture, other	5	10	5
9	64	forestry/wood products/wood treatment	6	9	5
10	56	automotive, aircraft and watercraft	9	6	5
11	90	pulp and paper	9	6	5
12	96	transportation	9	6	5
13	58	chlor-alkali	3	13	4
14	68	inorganic chemicals	6	10	4
15	67	industrial gas production	7	9	4
16	83	pharmaceuticals	8	8	4
17	65	food, feed, and beverage	9	7	4
18	80	paint and coating	6	11	3
19	59	construction materials	7	10	3
20	92	rubber products	8	9	3
21	72	mining, metal and non-metal	10	7	3
22	89	printing and publishing	14	3	3
23	76	organic chemicals, industrial	4	14	2
24	60	cosmetics	5	13	2
25	85	pigment, dye and printing ink	8	10	2
26	57	biotechnology	9	9	2
27	66	health and veterinary	11	7	2
28	79	packaging	11	7	2

Relative ranking	Industrial sector code		No. of times descriptor was assigned under scenario:		
	no.	description	"low"	"medium"	"high"
29	87	plastic and synthetic resin	12	6	2
30	95	textile, product	14	4	2
31	78	organometallic chemicals	9	10	1
32	62	explosive materials	12	7	1
33	86	plastics	12	7	1
34	61	electrical or electronic products	15	4	1
35	74	non-metallic mineral products, ceramic and glass	15	4	1
36	94	textile, primary manufacture	15	4	1
37	77	organic chemicals, speciality	9	11	0
38	70	leather/tanning	10	10	0
39	88	plating and surface finishing	10	10	0
40	84	photographic/photocopier	11	9	0
41	71	metallurgical	12	8	0
42	75	non-metallic mineral products, other	13	7	0
43	73	non-metallic mineral products, abrasive	15	5	0
44	55	article manufacture	16	4	0
45	52	adhesive and sealant production	17	3	0
46	69	magnetic tape manufacture	18	2	0

Attachment 5

DSL Functional Use Codes Ranked by Number of "Greatest" Descriptors Recorded

Relative ranking	Functional use code		Number of times descriptor was used:			Proportion of total for "greatest"
	no.	description	"least"	"intermediate"	"greatest"	
1	22	fragrance/perfume/deodourizer/ flavouring agent	0	1	19	95%
2	31	pesticide/herbicide/biocide/ disinfectant/ repellant/attractant	0	3	17	85%
3	23	fuel/fuel additive	0	4	16	80%
4	39	preservative	0	4	16	80%
5	44	solvent/carrier	0	4	16	80%
6	46	surfactant - detergent/emulsifier/ wetting agent/dispersant	0	5	15	75%
7	13	colourant - pigment/stain/dye/ink	0	6	14	70%
8	30	paint/coating additive	1	6	13	65%
9	16	fertilizer	1	9	10	50%
10	04	adhesive/binder/sealant/filler	2	8	10	50%
11	21	formulation component	3	8	9	45%
12	06	antifreeze/coolant/deicer	2	10	8	40%
13	50	water or waste treatment chemical	3	9	8	40%
14	27	lubricating agent/lubricant additive/mould release agent	4	8	8	40%
15	18	flame retardant/fire extinguishing agent	6	6	8	40%
16	32	photosensitive agent - fluorescent agent/ brightener/UV absorber	7	5	8	40%
17	33	plasticizer	6	7	7	35%
18	38	propellant/blowing agent	6	7	7	35%
19	17	finishing agent	4	10	6	30%
20	35	polymer, component of an article	5	9	6	30%
21	47	tarnish remover/rust remover/ descaling agent	6	10	4	20%
22	03	abrasive	9	7	4	20%

Relative ranking	Functional use code		Number of times descriptor was used:			Proportion of total for "greatest"
	no.	description	"least"	"intermediate"	"greatest"	
23	14	defoamer/emulsion breaker	9	8	3	15%
24	28	monomer	10	7	3	15%
25	43	sequestering agent	13	4	3	15%
26	34	polymer additive	7	11	2	10%
27	24	functional fluid i.e., hydraulic, dielectric, or their additives	8	10	2	10%
28	07	antioxidant/corrosion inhibitor/tarnish inhibitor/scavenger/antiscaling agent	9	9	2	10%
29	02	absorbent/adsorbent	10	8	2	10%
30	49	water repellant/drainage aid	4	15	1	5%
31	36	polymer, component of a formulation	6	13	1	5%
32	48	viscosity adjuster	9	10	1	5%
33	12	coagulant/coalescent	10	9	1	5%
34	45	stripper/etcher/discharge printing agent/de-inker	11	8	1	5%
35	25	humectant/dewatering aid/ dehumidifier/ dehydrating agent	13	6	1	5%
36	40	processing aid	13	6	1	5%
37	42	refrigerant	13	6	1	5%
38	29	oxidizing agent	14	5	1	5%
39	05	analytical reagent	17	2	1	5%
40	37	polymer, crosslinking agent	14	6	0	0%
41	08	catalyst/accelerator/initiator/activator	15	5	0	0%
42	19	flocculating/precipitating/clarifying agent	15	5	0	0%
43	41	reducing agent	16	4	0	0%
44	15	drilling mud additive/oil recovery agent/oil well treating agent	17	3	0	0%
45	11	chemical intermediate - inorganic, organometallic	18	2	0	0%
46	20	flotation agent	18	2	0	0%
47	26	ion exchange agent	18	2	0	0%

Relative ranking	Functional use code		Number of times descriptor was used:			Proportion of total for "greatest"
	no.	description	"least"	"intermediate"	"greatest"	
48	10	chemical intermediate - organic	19	1	0	0%
49	09	catalyst support/chromatography support	20	0	0	0%

Attachment 6

Comments Provided by Workshop Participants

Written comments were solicited from workshop participants concerning the use codes and their proposed application to the categorization of the DSL. Ample space was provided on the two worksheets for this purpose. Most participants opted to provide written comments, and both general and more specific comments and suggestions were received.

These handwritten comments are transcribed below, but are not attributed to the individual workshop participants (i.e., the order of the comments is *not* in the same order as the workshop participants listed in **Attachment 1**). Since the industrial sector codes were addressed first at the workshop, comments recorded on these worksheets appear first below.

In transcribing these handwritten comments, words were sometimes added for completeness or clarity and are enclosed in {these brackets}. When comments referred to use code numbers only (without the code description), the descriptions corresponding to these code numbers are also indicated in {these brackets}.

Comments recorded by workshop participants on industrial sector code worksheets

Scenario 1 depends on the nature of the DSL chemicals. For example, for adhesive and sealant production, exposure to solvent will be high in the process emissions, but probably not to resin in the adhesive.

Sector code seems {to have} two directions. One follows products (e.g., fertilizer; leather/tanning), and the other one is chemicals (e.g., inorganic, organics, etc.). That may add to the overlap or even confusion.

Overall, the industry sector code must be linked with group of chemicals to be relevant. That is because the exposure to chemicals in a given sector is really depending on the nature of chemicals. e.g., If a pesticide is registered under #53 {agriculture, field crops} the exposure probably will be high. However, if a lubricant {is} registered under the same #53 {agriculture, field crops}, the exposure could be very low.

Chemicals have to be categorized based on their physical-chemical properties, toxicity, environmental fate, etc. In other words, in a scientifically defensible manner. The industry sector and functional use code only serve as an indicator of the volume and potential route of exposure.

- -

Obviously the {industrial} sector codes in most cases are too ambiguous. I have starred (*) those that I think are less so but, perhaps, consideration of {industrial} sector codes {is} useless to consider exposure. Maybe functional use codes might work.

- -

This needs to be married with toxicity to get a risk ranking even if a broad toxicity rating is used. Otherwise it presents an incomplete picture.

- -

The suggested method for categorization is too ambiguous and vague. Quantities used in each category are too diverse in order to specifically label each code. Some descriptions are too general to make an educated guess.

Since many of the participants found this approach vague and since it was not an easy, clear-cut exercise, it would suggest that this may not be the best approach to DSL categorization.

- -

A brief description of process and list of substances for each code would have been most useful.

- -

It's difficult to accurately make estimates due to the span of some of the groups. Also, it is difficult due to the many industry types outside my area of experience and knowledge. I suspect that in some cases, there are chemicals within each class that could be classified differently, due to physical-chemical properties.

- -

Like we say from a toxicologist's view "the dose determines the poison." From this point of view, quantity determination in the marketplace and potency for hazard must be assessed properly. Unfortunately a toxicity factor should be considered.

The tool to be used for measuring the hazard is the hardest to select. Obviously, oral, inhalation and dermal toxicity should be considered. Available data from known chemicals from their toxicity should be "isolated" in a group first and substances with no or little data assigned to another group for further sorting according to their hazard potential.

We always relate exposure to toxicity and vice versa, so both aspects, I think, will have to be reflected somehow in the "codes" that will characterize a particular substance. Quite a task I admit, but it may have to be done!

- -

#81 pest control products/formulating and manufacture - our experience is that this type of facility is more closed than other chemical manufacturing

Some overlapping categories. e.g., Does "transportation" exclude "refined petroleum and coal products"? I assumed no.

- -

Exercise has merit for use with other items, e.g., volume, for first crude categorization.

Definitions for codes would have helped.

Rather than going with highest common denominator, e.g., high if any of scenarios 1, 2, 3 were high, could assign weightings of e.g., high = 10; medium = 5; low = 1 and generate a product.

#95 - textile, product - tend to be low levels, often impregnated into textile, not readily available

#80 - paint and coating - we toured some manufacturing facilities - wide range of sophistication from totally closed to totally open.

- -

Use codes have many limitations (multiple uses, change of uses, etc.). Perhaps more helpful would be a mechanism to rank specific uses with quantities applied to that use. Quantity may be best considered as "cumulative" as opposed to that which is imported annually. This is particularly significant for substances which are highly persistent.

Environmental exposure will come, to a large extent, from the substance, after it has entered the waste stream. The concept of life cycle management takes into account the effects of substances once they have entered the waste stream.

Substances bound in a solid matrix, such as paints and coatings, may not represent a risk for human exposure during the course of their lives as consumer products. However the integrity of the matrix over time will determine whether the substance has the potential to become subject to environmental release in the future. The paint and coatings industry has been very tight-lipped about the longevity of their products.

The recycling industry is gaining momentum as recycled substances become economically viable as alternatives to virgin materials. The recycling of substances needs to be accounted for when contemplating quantities, but also the industrial processes required to recover the substance from the waste stream and refine it to the point at which it may again be used in the manufacture of products.

Ingestion of substance present in consumer products may not be an issue for adults, but it is an issue for infants and toddlers (e.g., lead and cadmium in paint).

Lack of knowledge in the various industrial sector codes made it somewhat difficult for me to assign a code for each scenario.

- -

Scenario 1 was often the most difficult as I am unsure on the manufacturing processes of most of these things. Not sure if any of these occur in closed systems. It would be useful if in some way we could gather information on which of these are “closed” - perhaps by consulting the OECD. For many of the codes, scenario 2 was the easiest to rank as I have a better knowledge on consumer products. Since the categories were not designed for purposes of estimating exposure, it is quite difficult to determine if consumers will be contacting substances in some of the categories (e.g., non-metallic mineral products {codes 73, 74, 75}; plating and surface finishing {88}).

I do agree that if there is a general consensus on which use site categories have high vs. medium vs. low exposure {then} this exercise has been a success. However, if there is not a clear consensus this may be due to differences in interpreting the titles of the categories. There could be followup discussions on the “existing substances” interpretation of the categories versus what various participants thought. If possible, more information could be given about the category, even if it is just a definition created by the existing substances group.

- -

On your scale of utility, the use of industry codes would rank lower.

- -

Categories are not necessarily specific enough to the substances of concern. For each category there may be low, medium, high exposure to any number of substances used to make those products or to substances emitted from those products. Not enough information with respect to each category to make educated judgement on exposure.

Exposure for all scenarios {is} highly dependent on physical-chemical properties.

Emissions and effluents are generally assumed to be well regulated and controlled, however, could translate to quantities which may pose a risk in the presence of an identified hazard.

Would need to know information such as {whether} a substance is an intermediate or solvent, etc. to ascertain potential for exposure.

Since there was great difficulty in carrying out this exercise, it is likely not the best approach for categorization of the DSL.

- -

There could be significant overlap between some of these industrial sector codes. We need a more complete description of what segments of the industry are contained in each industrial sector code. i.e., industrial gas production {industrial gas production} vs. natural gas; inorganic chemicals {68} vs. 73 {non-metallic mineral products, abrasive}, 74 {non-metallic mineral products, ceramic and glass} and 75 {non-metallic mineral products, other}; 66 {health and veterinary} vs. 83 {pharmaceuticals}; 82 {petroleum and natural gas} vs. 91 {refined petroleum and coal products}, etc.

- -

I’ve used “medium” when I have no idea or low confidence. This is often related to a vague description of industrial sector. I’ve identified these.

Weakness in sector descriptions is the main weakness in this effort (obvious statement). Also, categories overlap, which causes some confusion.

I note that low exposure related to scenario 3 (following use/disposal) constitutes the main source of high confidence.

I’m assuming that transportation is petroleum related.

Overall, I’m not sure this (industrial sector) {is} of great use.

- -

Description of sector/examples would help. More examples of ranking would help. I had to do a lot of estimating and clear-cut cases were few.

- -

There seem to be a number of categories that overlap (i.e., automotive, etc. and transportation; health and veterinary and pharmaceuticals) - leads to some confusion.

- -

Unfortunate that there is no correlation between volumes versus use codes for any substances.....

Some categories are just too vague.

Overlapping categories (e.g., 96 {transportation}, 56 {automotive, aircraft and watercraft}, 82 {petroleum and natural gas}....)

- -

Scenario 1 is difficult to judge. Need to know processing and effluent details. Assumed worst case.

Considered the potential amount of use and the potential worst case is the form of the type of product to be used. e.g., liquid or gas - would likely move into the environment more freely and have a higher potential for exposure.

This may work if a second look at criteria is used. e.g., agricultural, other. Potential large use on food (consumed) products. “High” rating. Second look - it is a drum to hold agricultural products - therefore is “low.” This is simplistic, but it would capture potential exposure in the first instance and can be re-examined.

#74 - ceramics/glass {non-metallic mineral products, ceramic and glass} - high exposure if used to serve or contain foods. Unlikely to be a health concern unless, e.g., Pb in ceramic is present.

#83 {pharmaceuticals} - huge potential for exposure - present in urine and feces after consuming.

#65 {food, feed, and beverage} - high exposure but low tox. - food! - rated low - no further look will be needed.

- -

Without knowing whether a material is a consumable (a manufacturing or process aid) or a raw material, it is difficult to proceed intelligently to scenarios 2 and 3. When it is a raw material, is it changed into something else or merely mixed into the finished product? Diethanolamine is a nasty animal but is reacted to form diethanolamides in cleaning products. Scenario 2 and 3 ratings - low to nil. Sodium tripolyphosphate is blended into powdered detergents (industrial ones) where scenario 2 is high but scenario 2 or 3 is low or medium because it could be transformed during the cleaning process. Glycol ether solvents or surfactants stay unchanged so scenarios 2 and 3 are both high. So what do you do with sector 93 {soap and cleaning products}?

I doubt that any person at the table has a clue what sector 75{non-metallic mineral products, other} is about. I guessed and likely so did they. A more valid survey would be reached by contacting a sample of several hundred people and asking them to answer questions pertaining only to the industries they are familiar with. That way you would get enough answers on each category to be valid.

Scenario 1 should be given less weight than scenarios 2 and 3 because Canada is a net importer in many sectors, especially sector 61{electrical or electronic products}. In other sectors, 64 {forestry/wood products/wood treatment} being a major example, we are a net exporter so scenario 1 should be more important overall than 2 or 3.

Some manufacturers/processors have much better process/pollution controls than others. Presumably they are improving on average over time. How should we assess overall performance in scenario 1?

Some industry categories contain widely different processes. How do you rank titanium dioxide production (pigment) [or is it an inorganic chemical] with production of an azo dye, for one example?

Comments recorded by workshop participants on functional use code worksheets

Functional use code suffers the same “multitude of entry” as industry sector codes. For one chemical, there might be several functional codes, some will be rated high, while others rated low. The concern I have is how can we treat them separately. If we go for the highest exposure scenario, we may {be} overly conservative in estimating exposure situation.

- -

This is a much easier exercise. It is easier to estimate degree of exposure to substances as a function of use as opposed to types of industry.

- -

Same as before, some functional use codes need clarifying, and more info. on specific uses.

- -

Criteria, upon use, seem too much driven by consumer contact potential rather than “emission/effluent potential” and “disposal.” I’m thinking categorization driven to such an extent by consumer contact potential may not be the best way to go. I feel more confident with the “Industrial Sector” approach.

- -

Process may well be consumer product driven.

- -

I felt it easier to complete this worksheet compared to the first one.

- -

Since these functional codes look at fate during manufacturing and presence in consumer products - it doesn’t really capture the environmental fate or potential for exposure to environment via effluent or emissions. This may end up in a consumer based priority list. But substances which are used up during manufacturing may end up in drinking water and air resulting in high exposure potential for the general public.

The criteria for human contact parameter should have perhaps contained a component for potential in exposure medium, e.g., water, air.

- -

Much easier to rate than industrial sector codes because use is more specific and more clearly defined.

Level of exposure may depend on the specific substance but this may be level of categorization to stop at, otherwise too detailed.

May have concerns about environmental releases but would depend on whether concentrations are of concern.

- -

Seems more logical to use functional use than industry sector. Nonetheless, seems limited by lack of knowledge about use descriptions, not in all cases, but in some. This can result in a wide range of descriptors used plus variability within use (of details of use, concentration in products). Cross-referencing to sector could occasionally be useful.

Could be improved by more specific information on use. (Ed mentioned that the 55 EU codes had been broken up further to 400-some.) If a way could be found to get these definitions - or to make an informed guess - then potential utility could really be increased. (The 2 handouts provided - Pauley’s and the use lists - are a very good step in this direction.)

Ideal would be to have sub-categorization (if possible) involving concentration of substance (e.g., monomer in polymer) - but seems unlikely to be realizable.

N.B. - For some of these, I considered more than just consumer exposure. I’ve replaced “consumer product” in my active little mind with “medium to which average person is likely to be exposed.” If this leads to confusion or problems, gimme a call.

- -

Easier to do than industrial sector codes. Some conflict between fate and human contact parameters which caused some problems for classification. Could be solved by weighting.

- -

Just a general comment - I found it much easier to assign ratings for functional use codes than industrial sector codes.

- -

Easier than the first one. Criteria for inclusion are more complete which facilitates the process. Good description of the aspects of potential exposure.

- -

#38 - propellant {propellant/blowing agent} - greatest in general use but least in polymer formation. blowing agent - least. intuitively - if some category - industrial use only so answer could be least.

#45 - {stripper/etcher/discharge printing agent/de-inker} assume enclosed use in printing industry

Rightly or wrongly, felt more comfortable with my answers to these issues. I was prudent. If I determined that the product remains in the final product, I assumed it was “handled” by a large number of people. e.g., #39 {preservative}

#43 {sequestering agent} - If food sequestering agent - answer is greatest.

- -

The human contact parameter should probably be expanded/modified to take into account probability of contact. For instance a large proportion of the population comes into intimate {contact} or nearly so (depending on the case one takes) with fertilizers {16}. However, even on the first warm sunny Saturday in May it is doubtful if 10% of the population would be exposed to it. Likewise with antifreeze{06 antifreeze/coolant/deicer} in the winter.

Dried paint (containing additives which may slowly ablate or outgas) would get a damn near 100% contact rating. Liquid paint (where contact/exposure is infinitely more likely) might get about a 50% yearly rating but a less than 1% daily. It gets an intermediate rating both ways to my way of reading the criteria. Which is more relevant?

Things in manufactured articles (solids) are far less likely to have any acute effects than things in liquids. Both might have an equal potential to produce chronic harmful effects. The current parameters do not have any way of accounting for or distinguishing between the different types of exposure hazard.