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TOXIC SUBSTANCES CONTROL ACT
INVENTORY REPRESENTATION FOR
CERTAIN CHEMICAL SUBSTANCES CONTAINING
VARYING CARBON CHAIN LENGTHS
(ALKYL RANGES USING THE CX-Y NOTATION)

I. Introduction

This paper explains the conventions that are applied to certain listings of chemical substances containing ranges of alkyl chain lengths (i.e., carbon chains of varying lengths) for the Chemical Substance Inventory that is maintained by the U.S. Environmental Protection Agency (EPA) under the Toxic Substances Control Act (TSCA). This paper is restricted to substances using the general alkyl range notation of the type CX-Y, described in (1), below. The conventions applicable to this type of substance have been in place essentially unchanged since the inception of the Inventory. The Agency's goal in developing this paper is to make it easier for the users of the Inventory to interpret listings that include alkyl ranges and to understand how new substances should be identified for Inventory inclusion.

Fundamental to alkyl group nomenclature and to the Inventory as a whole is the principle that entries on the Inventory are interpreted as precisely descriptive as possible for the commercial chemical substance, as reported by the submitter. The following discussion assumes this principle.

Carbon chains of varying lengths are present in thousands of Inventory chemicals and are described by the use of four different types of Inventory representations. These types are:

- (1) General alkyl range notation of the type CX-Y for substances derived from natural sources and synthetics;
- (2) Soap and Detergent Manufacturers Association (SDA) descriptors of the type CX-Y for substances derived from natural fats and oils and their synthetic substitutes;

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- (3) Natural source descriptors; and,
- (4) Other, including EPA-American Petroleum Institute (API) petroleum process stream terms.

They are further described as follows:

(1) The subject of this paper is alkyl range notation of the type CX-Y. Carbon chains in this notation are represented by the nomenclature CX-Y where X is the smallest carbon chain to be included in the range and Y is the largest chain. The Agency uses the CX-Y notation to describe the carbon chains in the large number of substances for which the SDA, natural product and API systems are not appropriate or applicable. The substances

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described by this notation may be derived from a source not described in SDA nomenclature, be purified to enhance one or more of the alkyl chains from a natural source or be derived from two or more interchangeable sources. This paper presents the accepted practices governing the use of this notation, along with the nomenclature for the modifications that are found in Inventory substances.

Example 1. Alcohols, C7-9-branched
CASRN 68551-09-7*

(2) The SDA system of naming chemical substances derived from natural fats and oils and their synthetic equivalents was developed by EPA and the Soap and Detergent Manufacturers Association. (See references, for complete details.) The name for each substance using the SDA system includes one of 27 alkyl descriptors developed for the alkyl groups found in extensively-used fats and oils derived from natural plant and animal sources and their synthetic equivalents. SDA nomenclature is limited to the fats, oils and synthetic equivalents of the specific plant and animal sources listed in the SDA procedures; alkyl groups derived from other sources are not covered by the SDA nomenclature. The SDA name for a substance includes the alkyl descriptor, a functionality descriptor and a salt descriptor (if required) inserted in the appropriate SDA Substance Definition Format. Because alkyl descriptors are used instead of specific sources, manufacturers may have some limited flexibility to switch from one source to another under SDA nomenclature as long as the alkyl range descriptor encompasses the alkyl range of the fats and oils from the second source.

Example 2. Amines, tri-C6-12-alkyl
CASRN 68038-01-7*

The definition associated with this name is: "This substance is identified by SDA Substance Name: C6-C12, trialkyl amine and SDA Reporting Number: 13-044-00. Consult SDA Substance Identification Procedure."

(3) Natural source descriptors are used for substances with carbon chains derived from a single animal or vegetable source and identified by the popular commercial name of the plant or animal source (e.g., cottonseed oil, corn oil, ethoxylated tallow fatty acid, etc.). Source-based nomenclature is employed as a means of identifying substances using the name of the plant or animal source from which the substances are derived. In this system of nomenclature, substances named by their sources are not equivalent to substances derived from other sources, even if the chemical components of the two sources are identical.

In the case of synthetic substances, even if the chemical components of a synthetic substance are identical to the components of a substance derived from a natural source, the Agency does not use a natural source description to identify the synthetic substance. That is to say, a synthetic substance having an alkyl range cannot use a natural source name, regardless of its composition. Natural source descriptors are not considered equivalent to alkyl range descriptors.

In addition, the use of a source-based name implies a typical percent composition of individual carbon chain lengths. If a natural source material is processed to increase or decrease the relative amounts of the various chain lengths, the substance

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so obtained must be named using the CX-Y type of notation.

Example 3. Safflower oil, Me ester
CASRN 68938-50-1*

Example 4. (a) Fatty acids, tallow, hydrogenated
CASRN 61790-38-3*

(b) Fatty acids, C14-18
CASRN 67701-02-4*

The definition for this substance is: "This substance is identified by SDA Substance Name: C14-C18 alkyl carboxylic acid and SDA reporting number 17-005-00. Consult SDA Substance Identification Procedure."

Although they may appear to be identical chemically, these two Inventory entries are considered to be separate and are not equivalent for TSCA purposes. The first substance is named as a natural source material and the second is named as an SDA substance. The first substance must be made from tallow fatty acids and processed to produce hydrogenated tallow fatty. It is not equivalent to the second substance which may be made from any of the listed SDA sources that supply C14-18 fatty acids.

(4) The products manufactured in a petroleum refinery are treated as UVCB substances called process streams. Many of these comprise substances with carbon chains. Definitions of the petroleum process streams frequently include the range of carbon numbers of the substances in the stream; the carbon number range is indicative of the predominant composition of the process stream. Use of the word predominant in these definitions gives somewhat more flexibility for the carbon number range in any one process stream than is the case for the carbon number ranges in substances using the CX-Y nomenclature convention. As a further distinction from the CX-Y system, the definitions for petroleum streams are based on the total number of carbons in the product, not only those carbons in an alkyl range. The terms are defined in the API publication: "Petroleum Process Stream Terms Included in the Chemical Substance Inventory under TSCA."

Example 5. Distillates (petroleum), cracked steam-cracked, C5-17 fraction
CASRN 72230-71-8*

The definition associated with this substance is: "A complex combination of hydrocarbons produced by cracking a fraction of steam cracked distillates. It consists of predominantly alicyclic and aromatic hydrocarbons having carbon numbers predominantly in the range of C5 through C17 and boiling in the range of approximately 356oC to 932oC (180oF to 500oF).

II. Definitions

A. Definition of alkyl range

This paper is applicable to substances derived from natural sources and synthetics containing alkyl (i.e., carbon) chains of

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variable lengths. These are substances containing a range of carbon chain numbers, usually referred to as substances having an alkyl range. These substances are characterized by:

- (1) chains containing only carbon atoms connected to each other;
- (2) straight (unbranched) or branched chains;
- (3) the length of the chains (number of connected carbon atoms) including, if present,
 - (a) the carbon atoms in any branches, and
 - (b) the acyl carbons of carboxylic acid groups and their derivatives.

The chain length does not include carbon atoms that are part of a phenyl ring or other rings, or those that are separated from the alkyl chain by a phenyl ring, other rings, or an atom other than carbon. For example, the length of the alkyl chain in each of the following cases is only the length of the "R" group: R-Ph, R-N(CH₃)₂ or R-O(CH₂)₃NH₂.

B. Definition of Class 1 and Class 2 Substances

For purposes of the TSCA Inventory, chemical substances are divided into Class 1 and Class 2 substances. Class 1 substances are single compounds composed of molecules with particular atoms arranged in a definite, known structure. Their composition can be represented by a definite chemical structure diagram. Examples of Class 1 substances include: ethanol, benzene and carbon tetrachloride.

Many commercial substances do not, however, meet the stringent requirements for Class 1. They may have variable compositions, be composed of a complex combination of different molecules or be simple molecules without a definite chemical structure diagram. These are Class 2 substances. They are identified on the Inventory in a less precise manner than are Class 1 substances. They include three sub-classes of substances. First, some Class 2 substances can be represented by definite Hill ordered molecular formulae but have variable structural diagrams, such as xylene. Second, some Class 2 substances can be represented by definite molecular formulae but have unknown structural diagrams, such as aluminum nickel sulfide. Third, the majority of Class 2 substances have no definite molecular formula representation and either partial structural diagrams or no structural diagrams. Substances that fall within this group are often called UVCB substances: Chemical Substances of Unknown or Variable Composition, Complex Reaction Products and Biological Materials. Substances represented by alkyl ranges are all Class 2, UVCB substances. In the printed Inventory, UVCB substances are identified by an asterisk (*) following their CAS Registry Number (CASRN). In the examples in this paper, asterisks follow the CASRN of each UVCB substance.

Alkyl ranges of the CX-Y type may be found in a variety of Class 2 substances, from alkanes to complex reaction products. Examples from the Inventory include:

Example 6. Alkanes, C4-12
CASRN 68333-81-3*
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Example 7. Alkenes, C24-28 à-, polymers with acrylic acid
CASRN 68551-23-5*

Example 8. Carboxylic acids, C6-18 and C8-15-di-,
hydrogenated, polymers with adipic acid, azelaic
acid, neopentyl glycol and propylene glycol
CASRN 90247-42-0*

This substance is composed of polymers made from a
distillation cut that consists of two carboxylic acids
(i.e., hydrogenated C6-18-carboxylic acids and
hydrogenated C8-15-dicarboxylic acids), reacted with
adipic acid, azelaic acid, neopentyl glycol and
propylene glycol.

Example 9. Amines, C18-22-tert-alkyl,
(chloromethyl)phosphonates (2:1)
CASRN 79357-73-6*

III. Inventory Conventions with Illustrative Examples

A. The alkyl range, X-Y, includes all carbon chains between
and including the values of X and Y. In general, it
includes both even and odd numbers of carbon atoms. If
both X and Y are even numbers, however, the range may
include either (1) only the even numbers of carbon
atoms or (2) both even and odd numbers, depending on
the nature and/or source of the substance.

In general, fatty acids derived from natural fats and
oils usually contain only even numbers of carbon atoms
and not both even and odd numbers.

If a range of X-Y is given with either or both of the X and
Y values being odd numbers, the range X-Y is interpreted to
include all even and odd carbon numbers between and including X
and Y. For example,

Example 10. Alcohols, C1-3
CASRN 68475-56-9*

This substance contains saturated C1-, C2- and C3-
alcohols. The relative amounts of the alcohols are not
specified.

Example 11. Alkenes, C6-9 à-
CASRN 68526-99-8*

This substance is an unsaturated hydrocarbon having one
double bond on the first carbon, which could be
obtained by cracking naphtha or paraffin wax
(petroleum), followed by fractionation to obtain the
C6-9 cut. It includes C6-, C7-, C8- and C9-à-alkenes.

If the range of X-Y is given with both X and Y being even
numbers, the range between the X and Y values may include either
(1) all of the even and odd numbers of carbon atoms or (2) all of
the even numbers of carbon atoms. The choice of (1) or (2)
depends on a manufacturer's commercial intent and must be
consistent with the carbon numbers that are available from the
source or process used.

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For example, a substance could have been added to the Inventory based on even values for X and Y and the presence of all even and odd numbers of carbon atoms within the range between X and Y. Anyone manufacturing or importing a substance using this Inventory listing could, depending on circumstances, either have (1) all of the even and odd numbers of carbon atoms or (2) all of the even numbers.

Example 12. Alkanes, C4-12
CASRN 68333-81-3*

This substance may be interpreted to contain either (1) the C4-, C5-, C6-, C7-, C8-, C9-, C10-, C11- and C12-alkanes or (2) the C4-, C6-, C8-, C10-, and C12-alkanes, depending of the nature of the source and the manufacturer's intentions. An Inventory submission indicating that either (1) all carbon chain numbers in the range or (2) only all the even ones are present would result in the name, Alkanes, C4-12; the subsequent Inventory listing containing the C4-12 range would allow a person to make the substance with either type [(1) or (2)] of carbon chain content.

In the case of Example 12, if a manufacturer interprets the substance name to include both even and odd numbers of carbons, then each of the chain lengths between C4 and C12 must be in the overall composition. If, on the other hand, a manufacturer is dealing with a substance derived from a natural fat or oil, the manufacturer would be correct in interpreting the name to include only even carbon numbers, each of the six even chain lengths between C4 and C12 would be required to be present, and no odd chain lengths could be present. In either case, the chain numbers corresponding to the boundaries of the range, X and Y, must be present and no carbon numbers outside of the range may be intended to be present.

Example 13. Fatty acids, C8-18, ethoxylated
CASRN 68525-91-7*

This substance, being derived from natural fats and oils and their synthetic substitutes, is generally interpreted as containing the C8-, C10-, C12-, C14-, C16- and C18-ethoxylated fatty acids. This restrictive interpretation is appropriate because fatty acids derived from natural fats and oils usually contain only even numbers of carbon atoms.

Inventory descriptions for alkyl range products do not have any restrictions on the relative percentage of each alkyl component in the overall composition. The only requirement invoked by these TSCA Inventory descriptions is that all of the alkyl components expected from the name must be intentionally present at some level in the composition.

B. A substance listed by a broad range does not include substances described by a single alkyl number or a narrow alkyl range within that broad range.

The Agency's convention has always been that the ranges must match exactly for two substances to be considered equivalent for TSCA purposes.

Example 14. Alkenes, C6-12 à-

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CASRN 68855-57-2*

This substance is assumed to contain either (1) C6, C7, C8, C9, C10, C11 and C12 α -alkenes or (2) C6, C8, C10, and C12 α -alkenes. Compare this with:

Alkenes, C6-9 α -
CASRN 68526-99-8*

This substance is not the same as Alkenes, C6-12 α - because it does not contain the C10-12 α -alkenes. The following substances either mixed together or considered separately also do not cover the complete range between C6 and C12, and so are not the same as Alkenes, C6-12 α - for similar reasons:

Alkenes, C6-7 α -
CASRN 68783-15-3*

Alkenes, C8-9 α -
CASRN 68527-00-4*

C. If all of the individual substances within a Cx-y type alkyl range are independently listed on the TSCA Inventory, the substance named as that range is considered to be automatically on the Inventory as well.

A substance named with a broad alkyl range is considered to be on the Inventory if every specific substance within the range is independently on the Inventory. The broadly-named substance would be duplicative of the sum of the individual ones and so does not require its own Inventory listing.

The reverse, however, is not true: An Inventory listing for a broad alkyl range does not mean that each of the individual chain lengths in the range is necessarily on the Inventory itself. Each such individual chain length would require its own Inventory listing to be used separately in commerce for TSCA purposes.

Example 15. Since C3-alkane and C4-alkane are represented on the Inventory as "propane" and "butane" respectively, C3-4-alkanes is considered to be on the Inventory.

Propane
CASRN 74-98-6

This is the only linear C3-alkane; it is on the Inventory.

Butane
CASRN 106-97-8

This Inventory listing covers linear C4-alkane.

Alkanes, C3-4
CASRN 68475-59-2*

This substance includes only linear C3- and C4-alkanes, and is considered to be on the Inventory because propane and butane are on the Inventory. Note that

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branched and cycloalkanes are not included in this entry.

D. Blending of Two or More Alkyl Range substances

If two or more substances with alkyl ranges are blended without chemical reaction, the product is simply a mixture of the two substances.

Example 16. If a manufacturer blends the two substances, Alkanes, C6-8 and Alkanes, C8-18, the result, for TSCA Inventory purposes, is NOT the substance of the combined range, Alkanes C6-18, but rather a mixture of the two original alkanes.

E. If a mixture of two or more substances with overlapping or adjacent alkyl ranges is reacted, the reaction product is a substance with an alkyl range defined by the lowest and highest carbon numbers found in the alkyl range descriptors of the substances.

Example 17. A manufacturer reacts three substances, C4-8 alcohols, C8-18 alcohols and a diisocyanate. The Inventory name would describe the diurethane of the C4-18 alcohols. If, however, the manufacturer could then further distill or separate the product containing the C6-8 alcohols, the name would describe the diurethane of the C6-8 alcohols, for example.

F. If a mixture of substances containing alkyl ranges is fractionated by distillation and a distillate fraction contains alkyl components or ranges from two or more substances, the low and high carbon numbers that define the alkyl range of this fraction will be determined by the distillation conditions.

Example 18. A mixture of C4-8 alcohols and C8-18 alcohols was distilled to produce a cut containing the C4, C6, C8 and C10 linear, saturated alcohols. The distillate cut could be described as "Alcohols, C4-10."

G. Further examples of naming blends, reaction products and distillation cuts

A broad range that represents the low and high carbon numbers in the product may be used to name the reaction product of a blend only if all of the individual alkyl lengths implied by the name of the broad range are present.

Example 19. Two linear alcohols, Alcohols, C6-12 [CASRN 68603-15-6] and Alcohols, C10-16 [CASRN 67762-41-8] are blended by a manufacturer and are reacted with ethylene oxide. The distribution of alkyl chain lengths in the starting saturated, linear fatty alcohol is C6, C8, C10, C12, C14 and C16. An appropriate chemical description for purposes of the TSCA Inventory would be "Alcohols, C6-16, ethoxylated."

Further, if the chemical substance, "Alcohols, C6-16, ethoxylated," is on the TSCA Inventory, a manufacturer could use any two or more sets of alcohol ranges to

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make this product as long as all of the even-numbered linear and saturated chains were present.

Alternatively, the manufacturer could use any two or more sets of alcohol mixtures to make this product if all of the even and odd-numbered linear and saturated chains were present. No branched alcohol components may be intended to be present.

Example 20. Two linear alcohols,
Alcohols, C6-9 [CASRN 71076-86-3] and
Alcohols, C12-16 [CASRN 68855-56-1]
are blended by a manufacturer and are reacted with ethylene oxide. The chemical name "Alcohols, C6-16, ethoxylated" is not considered appropriate since it does not include all of the carbon numbers in the alkyl descriptor. The product is a mixture of Alcohols, C6-9, ethoxylated and Alcohols, C12-16, ethoxylated.

Example 21. A blend of linear saturated fatty acids is distilled to obtain a relatively pure dodecyl (C12) fatty acid. The fatty acid is reacted to form a methyl ester. Since the fatty acid is a single chain length without any isomeric variations, an alkyl descriptor is not appropriate. The Class 1 chemical name "Dodecanoic acid, methyl ester" [CASRN 111-82-0] is correct.

H. Conventions used for representing alkyl chains

1. Linear (i.e., normal) chains have no prefix

In other chemical representation systems, the prefix "n" is used to indicate that an alkyl chain is linear, or unbranched. The "n" prefix is often used in the trade literature as well. However, the CAS representation system used for the TSCA Inventory uses no prefix to indicate linear chains; linearity is assumed unless a prefix qualifies the substance differently. This difference in representation has led to some confusion. For TSCA purposes, if there is no modifying term with an alkyl substance name, the alkyl chain is assumed to be linear, with the point of attachment to the rest of the molecule at the first methylene (-CH₂-) group. The lack of such a prefix denotes a linear alkyl chain and that there is no branching, unless other terms denoting branching are included. For example,

Example 22. Alcohols, C6-9
CASRN 71076-86-3*

These chains of 6, 7, 8 and 9 carbons are all considered to be linear and saturated.

Example 23. Alkenes, C6
CASRN 68526-52-3

This CASRN represents a straight C6 chain with one or more double bonds in an unknown position. If the position of the double bond were known, the compound would be named as a Class 1 hexene.

2. "Branched" is used as a suffix for substances containing one or more branches at unspecified locations

Example 24. Alcohols, C16-20-branched

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CASRN 70693-04-8*

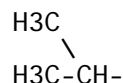
These chains are all branched and saturated.

3. "Branched and linear" is used for substances with both branched and linear chains

Example 25. Fatty acids, C14-18-branched and linear
CASRN 68937-77-9*

This substance includes both branched and linear saturated chains.

4. For alkyl chains through C6, "iso" is used in chemical synonyms to indicate the specific position of a methyl group attached to the carbon next to the last carbon of the alkyl chain. "Iso" is not used in Inventory listings for these low alkyl chains; rather, it is just used as a synonymous term for the basic structure:

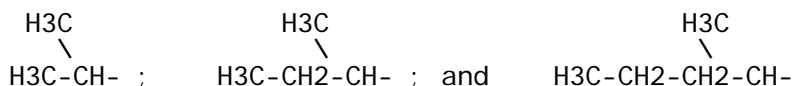


Example 26. Pentanal, 4-methyl -
(CH₃)₂CH-CH₂-CH₂-CH=O
CASRN 1119-16-0

The synonym for this substance in Inventory listings is Isohexanal. All of the C6 or lower isoalkyl structures include the substructure (CH₃)₂CH-(CH₂)_n-, where n = 0 to 3.

5. For alkyl chains of C7 and above, "iso" is sometimes used by submitters to indicate one methyl group at an unspecified location. However, EPA recognizes that the term "iso" may have been commonly and loosely used in the chemical industry to indicate an alkyl chain with extensive branching. There are some Inventory entries that may reflect this usage of "iso." If the nature of the branch and its locant are known, a specific name should be assigned to the alkyl fragment and its locant. If the branch is not fully described, the term "branched" should be used.

The structure of these iso chains is not specified, but may include such substructures as:



Example 27. Alkanes, C9-11-iso-
CASRN 68551-16-6*

The usual interpretation of this substance is a chain of 8 to 10 carbons with one pendant methyl group.

6. "Neo" represents the basic structure shown below where all of the hydrogen atoms on a carbon atom

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have been substituted with an alkyl group.

R'

R-C-R" where R, R', R", R''' = ò CH3

R'''

The use of "neo" as a synonym to describe an alkyl chain with a carbon number equal to 5 provides a Class 1 name (i.e., neopentyl- or neopentane, expressed as 2,2-dimethylpropyl or 2,2-dimethylpropane, respectively). In chains greater than 5, "neo" indicates a Class 2 substance containing the above structural component when the complete structure is indefinite. This term is generally not used for the TSCA Inventory unless specified by the submitter. If a definite structural diagram is provided, a specific name will be used to describe the substance.

Example 28. Neodecanoic acid
CASRN 26896-20-8

This name represents a substance of indefinite structure.

I. "Hydrocarbons" is used to name substances containing different classes of hydrocarbons

A substance containing two or more types of unspecified hydrocarbons from different classes of hydrocarbons, such as alkanes, alkenes, alkynes and aromatic hydrocarbons, is named as "hydrocarbons." In this special case, the carbon range may include carbons that are part of a phenyl ring or other aromatic ring. Any substance that contains only one type of hydrocarbon class would be named as that class of substance and not as "hydrocarbons." "Aromatic hydrocarbons" and "aliphatic hydrocarbons" are two such more restrictive names. For example, the following are two different substances for TSCA Inventory purposes:

Example 29. Hydrocarbons, C4-5
CASRN 68476-42-6*

This is an organic compound consisting exclusively of the elements carbon and hydrogen. It is derived principally from petroleum, coal tar and plant sources. It may include alkanes, alkenes and alkynes.

Example 30. Alkanes, C4-5
CASRN 68475-60-5*

This substance is limited to alkanes.

J. Conventions used for modifications

If a substance containing an alkyl range is modified, including a modification of the carbon chain, the name for the substance reflects the modifying process. Modifications common to alkyl range substances include ethoxylation, hydrogenation, and sulfonation. For example,

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Example 31. Alkenes, C2-3, hydroformylation products,
hydrolyzed
CASRN 68890-87-9*

Example 32. Amines, C12-18-alkyl, ethoxylated
CASRN 72968-37-7*

K. Largely unknown alkyl ranges are described by C>X

Alkyl ranges that are largely unknown, but for which the alkyl chains present are known to exceed some specified length are named as C>X, where X is one carbon less than the minimum carbon chain length present in the substance. Substance names with >X range designations are only used as a last resort for substances that cannot be described more specifically. Agency conventions do not allow this type of range designation if there is a more specific alternative, and the Agency would challenge vigorously any new listing of this type. An example of such a largely unknown alkyl range is:

Example 33. Alcohols, C>30
CASRN 71329-38-9*

The definition of this substance is: "The complex combination of high molecular weight alcohols obtained by the hydrolysis of the products from the reaction of ethylene and alkyl aluminum."

To match this Inventory listing, a substance would have to meet the restrictions of both the name (linear alcohols with more than 30 carbons) and the definition.

L. Substances enriched in one or more components within the alkyl range are given the suffix: "-rich"

If a substance includes a specific alkyl range and it has been manufactured to contain primarily one alkyl chain length (or sometimes more than one predominant alkyl chain size), it is named to reflect that enrichment.

In using nomenclature of this type, a manufacturer or processor needs to determine whether his substance is best described as (1) a single alkyl chain with impurities of other lengths or (2) an alkyl range that is enriched in that single chain length. The actual chemical composition, the market representation and the use of the substance are important considerations in making this determination. Two technically equivalent feedstocks may not be substituted for each other if the first feedstock is named as an alkane having a CX-Y range that is CX-rich and the second is simply named as the CX-alkane. For example,

Example 34. Hydrocarbons, C2-4, C3-rich
CASRN 68476-49-3*

This substance consists of hydrocarbons having carbon numbers predominantly in the range of C2 through C4, primarily C3. All three chain lengths are present and useful in the substance.

If only the C3-hydrocarbons were useful, the other two chain lengths would be considered as impurities or

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byproducts and the substance would be more
appropriately named as C3-hydrocarbons.

Hydrocarbons, C3
CASRN 68606-26-8*