Submission of Physical-Chemical and Toxicity Information on Some Subgroups of Premanufacture Notices

7

Submission of Physical= Chemical and Toxicity Information on Some Subgroups of Premanufacture Notices

PMNs SUBMITTED FOR CONSUMER PRODUCTS

Risk assessment encompasses two elements: 1) estimates of *hazard,* a property that resides in an object or substance or behavior; and 2) exposure that depends on estimates of the number of people or organisms that may come in contact with various amounts of the hazard for various times through different media. The highest exposure, in terms of people likely to be exposed, are associated with products intended for consumer use. Therefore, knowledge of hazard is especially important for these items.

Not only are there many consumers, but the chances for misuse probably increase with the number of users. Consumer-use items are purchased in retail outlets and may or may not be used according to directions. Labels and instructions may be lost, washed off, ignored, or not understood. A particularly striking example of such an occurrence was the mistaken use of a lemon-scented dishwashing detergent to flavor tea when samples of the product were mailed to consumers in 1982.

Table 15 presents the frequency with which physical-chemical and toxicologic data were submitted for consumer-use premanufacture notices (PMNs) and all other PMNs, and figure 7 shows the frequency of submission of some toxicity data. There were only small differences in the frequency of submission of physical-chemical data. Nine of the eleven toxicologic data were more frequently reported on consumer products. The two exceptions are reporting of acute inhalation toxicity and mutagenicity.

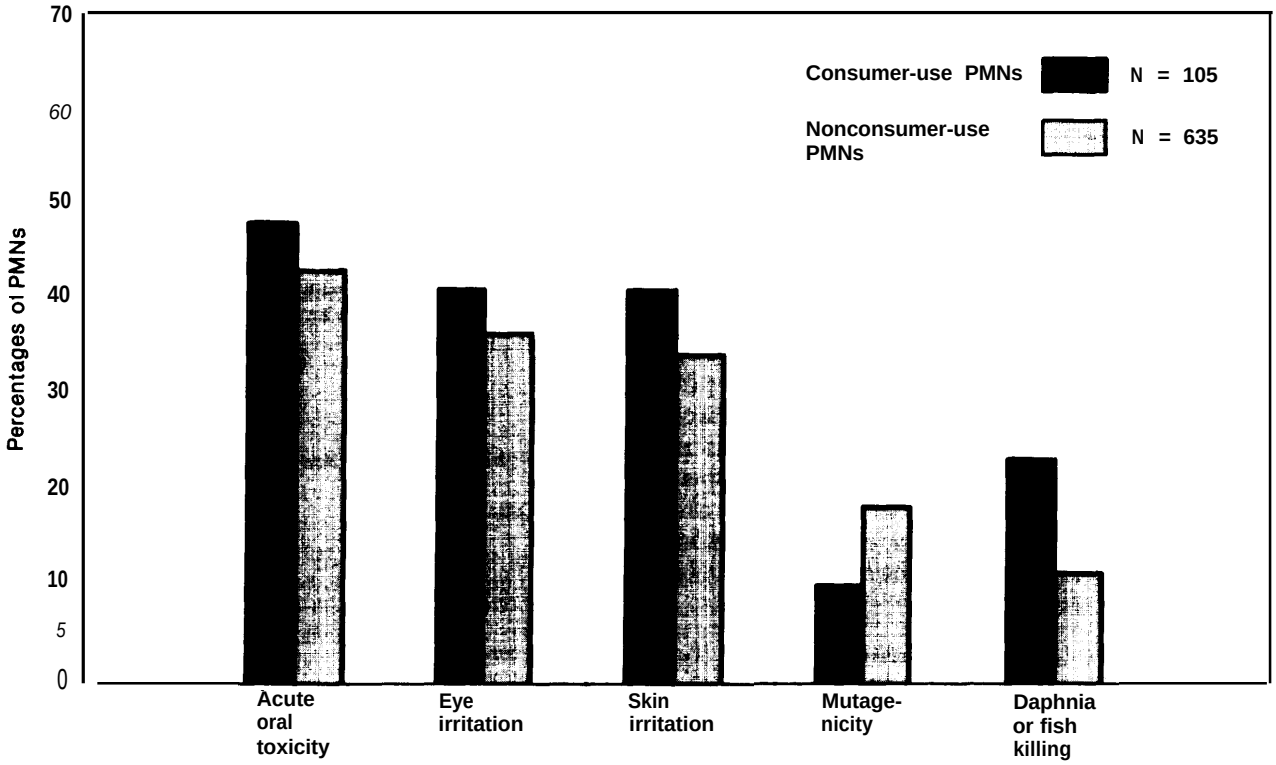
The overall more frequent submission of toxicity data fits with the idea that greater concern is frequently attached to consumer-use products. Because of the potentially great number of people exposed to these products, more information about any hazard is desirable to make reasonable decisions about risk. Despite the more frequent reporting of toxicity information on the consumer-use PMNs, more than half of such PMNs reported no toxicity data (see tables 18, 19, and 20).

Table 15.—Completeness of PMNs Submitted for Consumer-Use Products as Compared to Other PMNs

	Consumer-use PMNs		All other PMNs	
	No.	Percent	No.	Percent
Physical-chemical Information:				
PMNs	105	100	635	100
Infrared spectra	18	17	68	11
Purity	71	68	472	74
Analytical methods	63	60	351	55
Melting point	23	22	156	25
Boiling point	25	24	194	31
Density	22	21	118	19
Vapor pressure	27	26	153	24
Volubility water	45	42	263	41
Partition coefficient	4	4	23	4
Transportation	79	75	403	63
Emergency information	31	30	224	35
Toxicology information:				
Acute oral toxicity	50	48	270	43
Acute dermal toxicity	39	37	183	30
Acute inhalation toxicity	6	6	61	10
Skin irritation	39	48	211	33
Skin sensitization	17	16	49	8
Eye irritation	44	42	232	37
Repeated dose toxicity	20	19	66	10
Mutagenicity	11	10	116	18
Fish toxicity	14	13	50	8
Daphnia toxicity	10	10	19	3
Biological accumulation or biological degradation	5	5	31	5

SOURCE: Office of Technology Assessment.

Figure 7.-Percentage of PMNs That Described Consumer-Use or Nonconsumer-Use Products and Contained the Three Most Commonly Reported Toxicity Tests and Tests Related to Chronic Toxicity and Ecotoxicity



SOURCE: Office of Technology Assessment.

PMNs SUBMITTED FOR POLYMERS

According to the Environmental Protection Agency's (EPA) proposed exemption of polymers from PMN reporting requirements, polymers' high molecular weights make them inactive in most biological systems, and that property alone is sufficient to reduce the need for information about toxicity. OTA's findings about the amounts of information on polymer PMNs is presented in tables 9 and 14. Consistent with the idea that polymers were less hazardous, toxicity data were less frequently reported for those substances (table 14). The observation that physical-chemical data items were reported about equally for both polymers and non-polymers reflects the usefulness or necessity of such data in describing and identifying a chemical in the manufacturing plant.

EPA now receives fewer toxicity data about polymers than other substances. The proposed polymer exemption policy is expected to reduce further the amount of toxicity data submitted about those chemicals, but the tendency toward less information is already established. An interesting question that could be addressed by examining polymer PMNs in detail is whether or not toxicity information was more often submitted on PMNs that describe substances to be excluded from the exemption (see table 2).

PMNs SUBMITTED FOR SITE= LIMITED CHEMICALS

The number of people exposed to site-limited intermediates is necessarily limited. EPA's proposed exemption of these substances is based on the idea that knowledge about the use of these chemicals at their site of manufacture will be sufficient to make a decision between whether they may or may not present an unreasonable risk. Although the number of people that might be exposed is limited to those at the production site, exposure levels are potentially quite high. There may be a special incentive for companies to test site-limited intermediates because of concern about high-exposure levels.

OTA used the information provided on the PMNs to sort out the notices that described site-limited chemicals (see table 16). The notices examined by OTA are not exactly comparable to the group of chemicals proposed for exemption. EPA proposes to exempt site-limited intermediates, which are consumed or otherwise used only at the site of manufacture. OTA examined a somewhat larger universe, all those PMNs that described site-limited chemicals. The distinction between the two categories "site-limited intermediates" and "site-limited chemicals" is not entirely clear, but the first category is part of the second.

Table 16 shows a comparison of the amounts of physical-chemical information and toxicity data submitted for site-limited chemicals and all other chemicals. Overall, physical-chemical information was reported about equally on both groups of PMNs, and toxicity information was reported more frequently for site-limited chemicals. Over half (52 percent) of the PMNs describing site-limited chemicals reported oral toxicity data; 42 percent of the others did.

The equal reporting of physical-chemical information is to be expected. In general, such information is necessary for the manufacturer regardless of whether or not the chemical is moved from site to site. One item that is submitted less frequently on site-limited PMNs is information about transportation, which is completely reasonable for such chemicals.

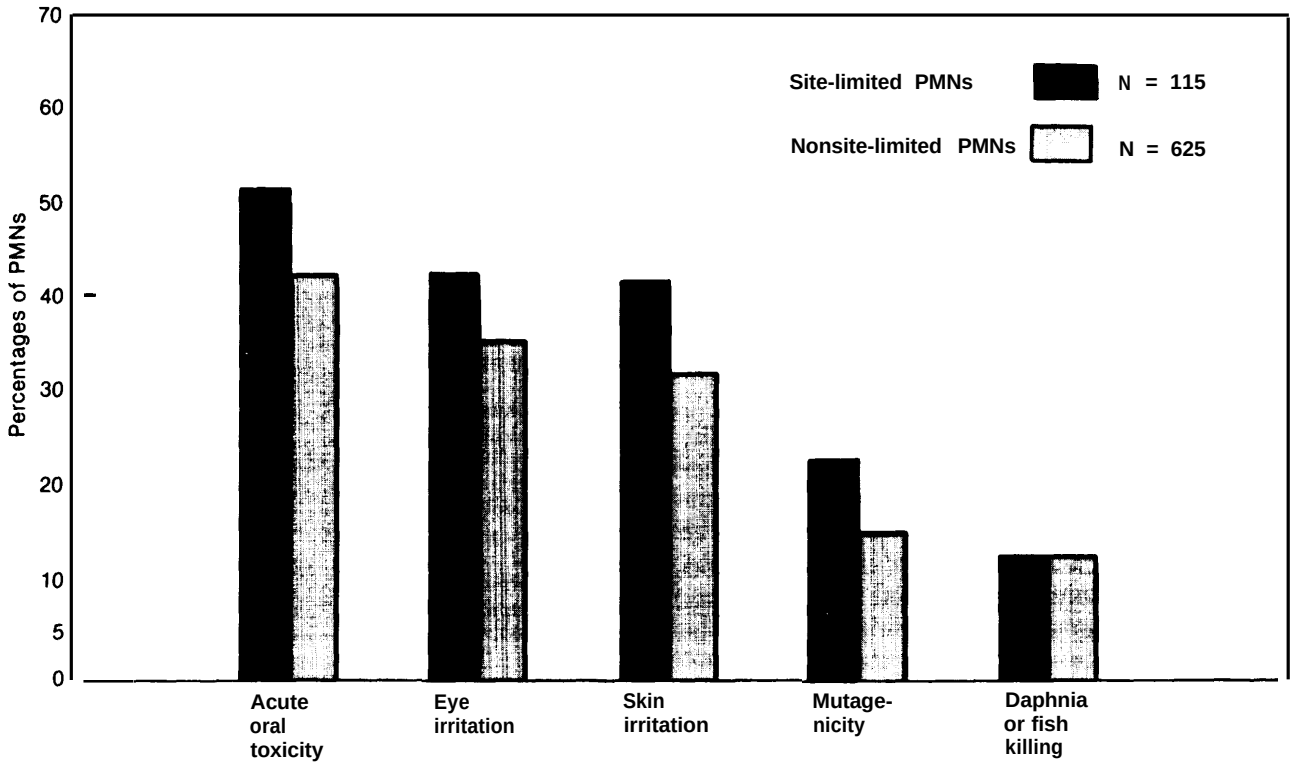
As shown on table **16** and figure **8,** toxicity information was reported more frequently for site-limited chemicals than for all others. Since EPA cannot require testing of new chemicals simply because they are new, it can be assumed that the development of toxicity information is done by manufacturers for their own needs.

Table 16.—Physical-Chemical and Toxicity information Submitted for Site-Limited Chemical PMNs and All Other PMNs

	Site- limited chemical PMNs		All other PMNs	
	No.	Percent	No.	Percent
Physical-chemical Information:				
PMNs	115	100	625	100
Infrared spectra	17	15	69	11
Purity	89	77	454	73
Analytical methods	68	59	346	55
Melting point	31	27	148	24
Boiling point	19	17	200	32
Density	14	12	126	20
Vapor pressure	21	18	159	25
Volubility water	51	44	259	41
Partition coefficient	1	<1	26	4
Transportation	49	43	433	69
Emergency information	30	26	225	36
Toxicology Information:				
Acute oral toxicity	60	52	260	42
Acute dermal toxicity	46	40	76	12
Acute inhalation toxicity	11	10	55	9
Skin irritation	50	43	200	32
Skin sensitization	16	14	50	8
Eye irritation	48	42	228	36
Repeated dose toxicity	14	12	72	12
Mutagenicity	25	22	102	16
Fish toxicity	12	10	52	8
Daphnia toxicity	2	2	27	4
Biological accumulation or biological degradation	6	5	30	5

SOURCE: Off Ice of Technology Assessment.

Figure 8.-Percentage of PMNs That Described Site= Limited or Other Chemicals and Contained the Three Most Commonly-Reported Toxicity Tests and Tests Related to Chronic Toxicity and Ecotoxicity



SOURCE: Office of Technology Assessment.

PMNs SUBMITTED FOR LOW-PRODUCTION-VOLUME CHEMICALS

The proposed low-volume exemptions argue that limited production volumes reduce the amount of information that EPA requires to make a judgment about any unreasonable risk that may be associated with a new chemical. An important caveat to any such generalization is that toxicity varies over an extremely wide range, and a miniscule amount of a very potent toxic substance can cause illness and death. However, most substances are not extremely toxic, and, regardless of toxicity, reduced exposure limits risk.

In general, substances to be manufactured in quantities less than 10,000 kg per year will be exempted from the usual PMN review unless they may cause serious acute or chronic health effects or significant environmental effects under conditions of use. The exemptions are discussed in ch. 2.

Some reviewers of the first draft of this report commented that EPA had truncated the review of some low-volume PMNs in the past. The shortened reviews were reported to have depended on professional judgment that: 1) production volumes were limited, and 2) either potential toxicity or exposure or both was low. Those reviewers characterized the proposed low-volume exemptions as being an extreme position because they depend so heavily on predicted production volumes.

For both low production volume exemptions, EPA will inspect the notice to assure that the

chemical qualifies for exemption. No chemical that receives a low-volume exemption will go on the Inventory. Therefore, manufacture of those substances by other companies will only be possible after submission of a PMN by the second company.

When (or if) the production volume exceeds **10,000** kg per year, EPA intends to require that the manufacturer submit a PMN for the substance. When PMN review is complete, the chemical will go on the Inventory. Part of the rationale for the low-volume exemption is that manufacturers will be better able to bear the reporting costs of the PMN review as production volume increases.

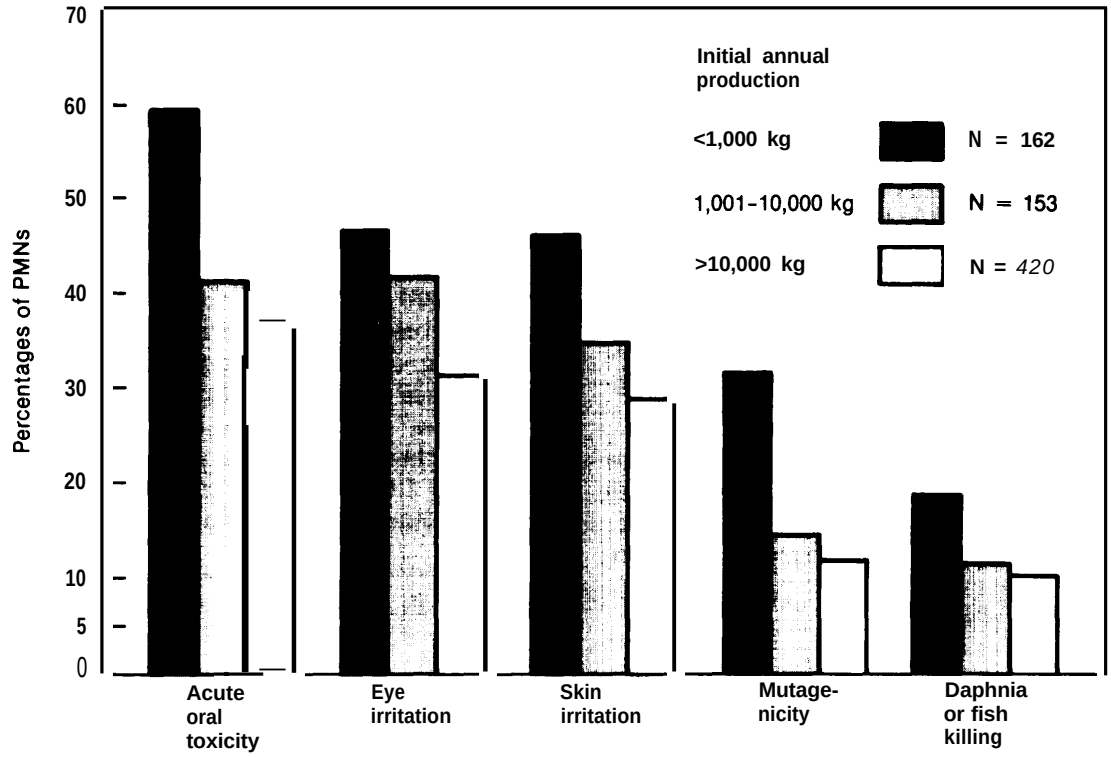
Table 17 reports and figure 9 abstracts some of the information content of PMNs reviewed for chemicals to be made in quantities of **1,000** kg or less in the first year, those to be made in quantities of 1,000 to 10,000 kg in the first year and all others. The frequency with which physical-chemical data are submitted fluctuates among the three volume classes, but there appears to have been more frequent reporting of toxicity information for PMNs that describe low-volume chemicals. The most striking differences in frequency of reporting toxicity data are acute ingestion toxicity and mutagenicity. Data from acute ingestion toxicity studies were reported on 59 percent of chemicals slated for production in volumes less than 1,000 kg; on 41 percent of those to be manufactured in volumes between **1,001** and 10,000 kg; and on 37 percent of those to be made in volumes greater than 10,000 kg. Mutagenicity data were reported more often for the lower volume chemicals; 31, 14, and 12 percent for the less than 1,000, between 1,001 and 10,000, and greater than 10,000 kg classes respectively.

Table 17.—Physical-Chemical and Toxicity Information Submitted on PMNs That Project Initial Year Production Volumes of 1,000 Kilograms or less, of Between 1,001 and 10,000 Kilograms, and All Others

	Initial year production volume					
	<1,000 kg		1,001-10,000 kg		>10,000 kg	
	No.	Percent	No.	Percent	No.	Percent
Physical-chemical Information:						
PMNs	162	100	153	100	420	100
Infrared spectra	14	8	19	12	53	13
Purity	118	73	117	76	305	73
Analytical methods	73	45	87	57	254	60
Melting point	61	38	34	22	83	20
Boiling point	38	23	39	25	141	34
Density	19	12	20	13	98	23
Vapor pressure	36	22	22	14	122	29
Volubility water	73	45	63	41	169	40
Partition coefficient	4	2	4	3	19	4
Transportation	84	52	99	65	297	71
Emergency information	47	29	60	39	148	35
Toxicology information:						
Acute oral toxicity	98	59	64	41	154	37
Acute dermal toxicity	51	31	44	29	124	30
Acute inhalation toxicity	11	7	17	11	38	9
Skin irritation	74	47	53	35	118	28
Skin sensitization	25	15	12	8	29	7
Eye irritation	76	47	66	43	136	32
Repeated dose toxicity	29	18	14	9	41	10
Mutagenicity	51	31	22	14	52	12
Fish toxicity	19	12	13	8	32	8
Daphnia toxicity	10	6	6	4	13	3
Biological accumulation or biological degradation	9	5	6	4	21	5

SOURCE: Office of Technology Assessment.

Figure 9.—Percentage of PMNs That Described Low- or High-Production-Volume Chemicals and Contained the Three Most Commonly Reported Toxicity Tests and Tests Related to Chronic Toxicity and Ecotoxicity



SOURCE: Office of Technology Assessment.

COMPARISON OF TOXICITY DATA SUBMITTED ON CONSUMER AND NONCONSUMER SUBSTANCES, BOTH POLYMERS AND NONPOLYMERS, SCHEDULED FOR PRODUCTION IN DIFFERENT AMOUNTS

The finding that PMNs that described low-volume chemicals reported toxicity data more frequently might reflect a reluctance on the part of manufacturers to test high-volume chemicals or to report results. Given that the risk estimate for high-volume chemicals is already elevated because of high potential exposure, manufacturers might think that any hint of toxicity may cause EPA to require even more testing to allay fears. Furthermore a company that submits a PMN expects to manufacture the chemical, and it is not interested in expending more time and energy on additional tests. Therefore there might be few incentives for a company to test or to report test results on high-volume chemicals.

Alternatively, OTA considered that fewer toxicity data are reported for high-volume chemicals because manufacturers have had a great deal of experience with closely related substances and are satisfied that the new chemicals are not hazardous. An obvious class of such chemicals is polymers.

The data presented in table 18 show the frequency of submission of toxicity data for polymers and nonpolymers at different projected pro-

Table 18.—Number of Submissions of Toxicity Data on Polymers and Nonpolymers To Be Produced in Different Amounts

	<1,000 kg				1,001-10,000 kg				>10,000 kg			
	Polymer		Non polymer		Polymer		Non polymer		Polymer		Non polymer	
	No.	Percent	No.	Percent	No.	Percent	No.	Percent	No.	Percent	No.	Percent
PMNs	37	100	127	100	56	100	100	100	291	100	143	100
Acute oral toxicity	16	43	80	63	14	25	50	50	65	22	89	62
Acute dermal toxicity	6	16	45	35	8	14	36	36	53	18	71	50
Acute inhalation toxicity	1	2	10	8	6	11	11	11	17	6	21	15
Skin irritation	11	30	63	50	16	29	37	37	42	14	76	53
Skin sensitization	1	1	24	19	6	11	6	6	9	3	20	14
Eye irritation	13	35	63	50	18	32	43	43	54	19	82	57
Repeated dose toxicity	4	11	25	*20*	*4*	*7*	10	10	15	5	26	18
Mutagenicity	8	*22*	*43*	*34*	1	2	21	21	*19*	*7*	*33*	*23*
Fish toxicity	4	11	15	12	2	4	11	11	10	3	22	15
Daphnia toxicity	2	5	8	6	1	2	5	5	6	2	7	5
Biological accumulation or biological degradation	0	—	9	7	0	–	6	6	7	2	14	10

SOURCE: Office of Technology Assessment.

duction volumes. As can be seen, fewer data were submitted on polymers at all production volumes. For nonpolymers, toxicity data submission was more frequent on the PMNs that predicted higher production volumes.

The data relating polymers and production volumes were further broken down to examine submission of toxicity data on consumer products (tables **19** and **20).** Toxicity data were more frequently submitted on nonpolymers whether they described consumer- or nonconsumer-use chemicals. For nonpolymers to be made in greater than 10,000 kg volumes annually, the reporting of toxicity data was more frequent than for PMNs as a whole (compare table 12 with tables 19 and **20).** The frequency of submission of toxicity data for nonpolymers was generally higher for substances intended for consumer use (tables 19 and 20).

Another observation to be made from table 19 is that over half **(56** percent) of consumer-use PMNs described chemicals to be made in volumes greater than 10,000 kg annually. Therefore, less than half (44 percent) of consumer-use chemicals, which are of special concern because of their exposure characteristics, were slated for production

Table 19.-Number of Submissions of Toxicity Data on PMNs Describing Consumer-Use Chemicals and Polymers and Nonpolymers To Be Produced in Different Amounts

	<1,000 kg		1,001-10,000 kg		>10,000 kg			
					Polymer		Nonpolymer	
	No. polymer	No. nonpolymer	No. polymer	No. nonpolymer	No.	Percent	No.	Percent
PMNs	2	19	10	15	35	100	23	100
Acute oral toxicity	1	11	2	7	12	34	16	70
Acute dermal toxicity	1	7	1	6	12	34	12	52
Acute inhalation toxicity	0	0	0	1	2	6	3	13
Skin irritation	1	9	2	6	7	21	13	57
Skin sensitization	0	6	1	3	3	9	4	17
Eye irritation	1	7	2	6	13	38	15	65
Repeated dose toxicity	0	5	1	1	4	12	8	35
Mutagenicity	0	3	0	0	4	12	4	17
Fish toxicity	1	2	1	1	3	9	6	26
Daphnia toxicity	1	2	0	1	3	9	3	13
Biological accumulation or biological degradation	0	0	0	1	1	3	3	13

SOURCE: Office of Technology Assessment.

Table 20.—Number of Submissions of Toxicity Data on PMNs Describing Nonconsumer-Use Chemicals and Polymers and Nonpolymers To Be Produced in Different Amounts

	<1,000 kg				1,001-10,000 kg				>10,000 kg			
	Polymer		Non polymer		Polymer		Non polymer		Polymer		Nonpolymer	
	No.	Percent	No.	Percent	No.	Percent	No.	Percent	No.	Percent	No,	Percent
PMNs	35	100	108	100	46	100	85	100	256	100	120	100
Acute oral toxicity	15	43	70	65	12	26	43	51	53	21	74	62
Acute dermal toxicity	5	14	38	35	7	15	30	35	41	16	60	50
Acute inhalation toxicity	1	3	10	9	6	13	10	12	15	6	19	11
Skin irritation	10	29	55	51	14	30	31	36	35	14	64	53
Skin sensitization	1	3	18	17	5	11	3	4	6	2	16	13
Eye irritation	12	34	57	53	16	35	37	44	41	16	68	57
Repeated dose toxicity	4	11	20	18	3	6	9	11	11	4	18	5
Mutagenicity	8	23	41	38	1	2	21	25	15	6	29	24
Fish toxicity	3	9	13	9	1	2	10	12	7	3	16	13
Daphnia toxicity	1	3	6	6	1	2	4	5	3	1	4	3
Biological accumulation or biological degradation	0	—	9	8	0	–	5	6	6	2	11	9

SOURCE: Office of Technology Assessment.

in volumes equal to or less than those proposed for exemption by EPA.

The skewing of production volumes toward higher values is most noticeable for polymers being produced for nonconsumer uses (table 20). Seventy-six percent of all nonconsumer-use polymers are slated for production in volumes greater than 10,000 kg annually.

The frequency of submission of toxicity data for nonconsumer-use polymers tends to decrease with increasing projected production volumes. An easy-to-hand suggestion to explain that tendency is that large production volume non-consumer-use substances are often "me too" chemicals. Manufacturers might be well acquainted with the properties of closely related substances and satisfied with estimates of toxicity based on them. Apparently EPA is also satisfied with those estimates.

MAGNITUDE OF SCALE-UP IN PRODUCTION OF LOW-VOLUME CHEMICALS

Because of concerns about confidential business information, OTA did not collect precise estimates of first- and third-year production volumes. Instead, first year production was collected as:

1. 1,000 kg or less,
2. 1,001 kg to 10,000 kg, and
3. greater than 10,000 kg.

Third year production volume was recorded as a multiple of the first year volume:

1. Less than a fivefold increase,
2. fivefold to tenfold increase,
3. twentyfold to fiftyfold increase,
4. fiftyfold to hundredfold increase,
5. hundredfold to two hundredfold increase, and
6. greater than two hundredfold increase.

Table 21 shows the expected scale-up of production of chemicals from each of the initial year production volumes. Also shown are estimates of the kilograms of each chemical to be expected in the third year. These estimates are necessarily imprecise because exact production volumes were not recorded. Instead, as is shown on the table, an initial year production volume of 500 kg was assumed for the less than 1,000 kg class, 5,000 for the 1,001 to 10,000 kg class, and 10,001 (rounded down to 10,000) for the greater than 10,000 kg

Table 21.—Estimated First Year Production Volumes, and Increases Expected in the Third Year

Initial year production volume	Increase in third year		Estimated[a] first year product ion (kg)	Estimated third year product ion (kg)
<1,000 kg	< 5-fold[b]	101	500	500-2,500
	5- to lo-fold	23	500	2,500-5,000
	10- to 20-fold	11	500	5,000-10,000
	20- to 50-fold	5	500	10,000-25,000
	50- to 100-fold	0	500	—
	100- to 200-fold	4	500	50,000-100,000
	> 200-fold	11	500	>100,000
		135		
1,001 kg to 10,000 kg	<5-fold	81	5,000	5,000-25,000
	5- to 10-fold	41	5,000	25,000-50,000
	10- to 20-fold	11	5,000	50,000-100,000
	20- to 50-fold	9	5,000	100,000-250,000
	50- to 100-fold	6	5,000	250,000-500,000
	100- to 200-fold	2	5,000	500,000-1,000,000
	> 200-fold	0	5,000	—
		150		
>10,000 kg	c 5-fold	193	10,000	10,000-50,000
	5- to 10-fold	50	10,000	50,000-100,000
	10- to 20-fold	11	10,000	100,000-200,000
	20- to 50-fold	3	10,000	200,000-500,000
	50- to 100-fold	1	10,000	500,000-1,000,000
	100- to 200-fold	7	10,000	1,000,000-2,000,000
	> 200-fold	0	10,000	—
		265		

[a] *See* text.
[b] For brevity the increases are written as 5- to 10-fold, 10- to 20-fold, etc. In practice, 5-to 10-fold means equal to or greater than 5 and less than 10, 10- to 20-fold means equal to or greater than 10 and less than 20, etc.

SOURCE: Office of Technology Assessment.

class. The assumption of 500 for the first class and **5,000** for the second class may be either high or low; the assumption of 10,000 for the third must be low.

In all three classes, production of more than half of all the chemicals increases less than fivefold. At the other end of the production increase scale, 15 of the 155 less than 1,000 kg initial year production volume chemicals are expected to increase by at least 50 times in the third year. The comparable fraction for the 1,001 to 10,000 kg class is 8/150; for the more than 10,000 kg, 8/265.

EPA expects to require PMN review for low-volume chemicals when their production increases to at least **10,000** kg per year. It is impossible to predict, from OTA's collected data, what number of PMNs report chemicals that will increase to 10,000 kg production volumes in the third year. However, if all chemicals in the less than 1,000 kg per year class that increase by 20-fold or more have an initial production of at least 500 kg, then 20 of the 155 chemicals of that class will require PMN review in the third production year. For the 1,001 to 10,000 kg class, if all the chemicals that increase in production at least fivefold have first year production volumes of at least 5,000 kg, 69 of the I50 will require PMN review in the third year. These estimates suggest that many chemicals exempted from PMN review because of low production volume when they are first introduced will be subject to review in their third year of production.

ARE PMNs SUBMITTED FOR IMPORTED CHEMICALS MORE COMPLETE THAN THOSE SUBMITTED FOR OTHER CHEMICALS?

The European Economic Community (EEC) has adopted a base set of tests that are required before a new substance can be marketed in member countries. It is not an overstatement to contrast the EEC and the Toxic Substances Control Act (TSCA) requirements by saying that EEC demands that several kinds of test data be submitted unless an exemption is granted; TSCA does not authorize EPA to require generation of test data unless EPA lacks information to make a determination about some unreasonable risk that the substance may present.

No impact of the EEC requirements would be expected on the PMNs examined by OTA because they were not in effect in 1979 and 1980. Nevertheless, the PMNs that described imports were examined separately. A comparison of import PMNs to all other PMNs is shown in table 22. The frequency with which chemical identification data were submitted was essentially 100 percent for both domestic and imported PMNs, but imports less frequently reported byproducts, numbers of workers, and disposal (data not shown). Those smaller numbers may largely be explained because byproducts, workers, and disposal methods in foreign countries are not a concern for the United States EPA.

As is shown on table 22, neither physical-chemical nor toxicity data were consistently reported more frequently on the import PMNs. Seven of the eleven physical-chemical items were more frequently present on domestic PMNs; **6** of the 11 toxicity items.

Table 22.—Physical-Chemical and Toxicity Information Submitted for Import PMNs and All Other PMNs

	Imports		All other PMNs	
	No.	Percent	No.	Percent
Physical-chemical Information:				
PMNs .,	63	100	677	100
Infrared spectra	4	6	82	12
Purity.	45	71	498	74
Analytical methods	46	73	368	54
Melting point	24	38	155	23
Boiling point	12	19	207	31
Density	10	16	130	19
Vapor pressure	9	14	171	25
Volubility (water)	30	48	278	41
Partition coefficient	2	3	25	4
Transportation	53	84	429	63
Emergency information	21	33	234	35
Toxicology information:				
Acute oral toxicity	35	55	285	42
Acute dermal toxicity	12	19	210	31
Acute inhalation toxicity	2	3	65	10
Skin irritation	23	36	227	*34*
Skin sensitization	3	5	63	*9*
Eye irritation	22	35	254	*38*
Repeated dose toxicity	4	6	82	*12*
Mutagenicity	15	24	112	*17*
Fish toxicity	13	21	51	*8*
Daphnia toxicity	1	2	28	4
Biological accumulation or biological degradation	9	14	27	4

SOURCE: Office of Technology Assessment.