Chapter 5

Agency Responses to the *Annual Report on Carcinogens* and NCI/NTP Test Results

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INTRODUCTION

In this chapter, OTA examines Federal agency responses to the list of carcinogens in the ***Annual Report on Carcinogens*** and to positive results for chemicals tested in the carcinogenicity bioassays conducted by the National Cancer Institute (NCI) and National Toxicology Program (NTP). This analysis only provides summary information about the chemicals that may be considered carcinogenic based on the ***Annual Report*** or positive NCI/NTP bioassay results and describes the extent of agency actions on these chemicals. (As in the rest of this background paper the term "chemical" is used here broadly to include substances, mixtures, groups of substances, and exposures.)

Not all factors important in regulatory decisions are encompassed by the present analysis. In particular, estimates of the risk presented by these chemicals (including the qualitative weight of the evidence, quantitative potency estimates, and quantitative exposure estimates), agency judgments that these risks are reasonable or unreasonable, the availability of control technologies, and the costs of controls are not considered here. As discussed in chapter 3, another important issue is the time needed to develop, propose, issue, defend, and implement new regulations. This analysis, however, does not discuss the time agencies take to respond to identified carcinogenic chemicals. Finally, OTA did not attempt to evaluate the level of protection provided by the regulations that have been issued. The analysis focused just on whether or not regulations had been issued.

THE *ANNUAL REPORT ON CARCINOGENS*

History of the *Annual Report*

The ***Annual Report on Carcinogens*** was mandated by Congress in the 1978 amendments to the Community Mental Health Centers Act (Public Law 95-622). The idea of an annual report was first raised publicly in oversight hearings on the NCI held in March of that year. Witnesses testified that no agency kept a comprehensive list of carcinogenic chemicals, and that while some chemicals were regulated by one agency, the same chemicals were not regulated by other agencies. Representative Andrew Maguire introduced a bill to require that NCI publish a list of carcinogenic chemicals. He hoped that the report would educate the public, serve as a point of reference for scientists and regulators, and evaluate the activities of the regulatory agencies, who are not immune to pressure from the outside (113).

The bill first passed by the House of Representatives had specified that NCI would be responsible for the report and that the report should contain three elements:

- a list of all known or suspected carcinogens,
- information concerning the nature of exposure and number of individuals exposed, and
- an evaluation of the efficacy of existing regulatory standards designed to control suspected carcinogens (197).

In the final version, responsibility was given to the Department of Health and Human Services (DHHS), and "suspected carcinogens" was changed to "substances . . . reasonably anticipated to be carcinogens." As enacted, the law requires that the report include the following:

> . . . a list of all substances (i) which either are known to be carcinogens or may reasonably be anticipated to be carcinogens and (ii) to which a significant number of persons residing in the United States are exposed (Public Law ***95-622).***

The provision mandating the evaluation of existing standards was modified to require that the ***Annual Report*** determine the following information:

> (i) each substance . . . for which no effluent, ambient or exposure standard has been established by a Federal agency, and
> (ii) for each [existing] standard . . . the extent to which, on the basis of available medical, scientific, or other data, such standard and the implementation of such standard by the agency decrease the risk to public health from exposure to the substance (Public Law ***95-622).***

Finally, the law requires that the ***Annual Report*** describe requests from Federal agencies for carcinogenicity testing and the responses of DHHS to those requests.

The original sponsor of this legislation, Andrew Maguire, and Paul Rogers, the chair of the subcommittee from which the legislation was originally reported, both argue that these changes did not alter the intent of the original legislation (113,177). Paul Rogers described the regulatory importance of the ***Annual Report:***

> The intention of the legislation was that listing in the annual report would be a first step in regulation, one triggering a review by the agencies responsible for enforcing various laws regulating carcinogens ***(175).***

Development of the *Annual Report*

In ***the Annual Report,*** "known carcinogens" are defined to be human carcinogens, while animal carcinogens are deemed to be "substances . . . reasonably anticipated to be carcinogens. " New chemicals are usually included in the ***Annual Report*** after testing positive in NCI/NTP bioassays in both sexes of one species and in at least one sex of a second species.[1]

The substances to be included in the ***Annual Report*** are selected by an interagency committee, with representatives from NCI, U.S. Consumer Product Safety Commission (CPSC), Environmental Protection Agency (EPA), Food and Drug Administration (FDA), National Institute of Environmental Health Sciences (NIEHS), National Institute for Occupational Safety and Health (NIOSH), National Library of Medicine (NLM), and Occupational Safety and Health Administration (OSHA). The committee compiles a list of chemicals based on the previous ***Annual Report,*** International Agency for Research on Cancer (IARC) reports, NTP animal testing results,[2] other peer-reviewed carcinogenesis studies, and data on chemical exposures from a variety of sources. The draft list is published for public comment, after which the committee makes its final selections.

While the legislation provided for a yearly report, in practice the reports have not been issued annually. Mandated by Congress in November 1978, the first report was dated July 1980; the second, December 1981; and the third, September 1983. The fourth report is dated "1985," although copies were not widely available until mid-1986. Much of the delay in issuing 1985 report was due to review within DHHS (26).

This year, for the first time, NTP held a public meeting to receive comments on chemicals to be listed in the fifth ***Annual Report.*** A number of interested trade associations, unions, public interest organizations, and individuals presented comments on the ***Annual Report.*** Many of the individuals and groups thought highly of the ***Annual Report*** and found it to be a useful reference. Some participants suggested that more chemicals be listed by using less stringent selection criteria. In addition, they wanted the ***Annual Report*** to focus attention on chemicals that should be subject to further regulatory activity (113,173,363).

A number of trade associations expressed concern, however, about the process used to develop the ***Annual Report.*** These groups suggested that NTP adopt written guidelines for determining listing in the ***Annual Report*** (specifying, in particular, the use of a "weight of the evidence" approach), that NTP develop more information on exposures (especially evaluating likely human exposures in relation to animal test exposures), and, in developing the report, that NTP give earlier public notice, more explanation of the rationale

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IUsing the terms of the next section, this means three or four positive experiments (clear evidence or some evidence) in an NTP bioassay.

'That these results are included leads to some overlap in this chapter between discussions of agency responses to ***Annual Report*** listings and positive results of NCI/NTP tests.

for chemical selection, and greater opportunity for public participation. Some participants also expressed concern that NTP was using the conclusions of an international organization, the IARC, to determine listing in the ***Annual Report*** (4,30,80).

Increased interest in the ***Annual Report*** has arisen in part because it is now being used to trigger regulatory requirements. OSHA is using the ***Annual Report*** as part of its hazard communication or "labeling" standard. That standard requires, first, that chemical manufacturers assess the hazards of the chemicals they produce and transmit this information to employers and employees and second, that employers provide hazard information to employees through a system of warning labels, employee training about hazardous chemicals, and employee access to material safety data sheets. The OSHA standard mandates that a chemical be considered a carcinogen (and hazardous) if it is included in the ***Annual Report*** or the IARC monograph series, or if it is regulated by OSHA as a carcinogen. The material safety data sheet for the chemical must also indicate this.

Several State worker and community "right to know" laws also use the ***Annual Report*** to trigger coverage. In addition, the recently enacted California proposition 65 ("the 1986 Safe Drinking Water and Toxic Enforcement Act") establishes rules and warning requirements for chemicals "known to cause cancer. " To identify these substances, proposition 65 refers to the OSHA hazard communication standard, which in turn refers to the ***Annual Report.***

Contents of the *Annual Report*

The ***Annual Report*** covers the reasons for listing substances; summaries of chemical properties; descriptions of production, uses, and exposures; and information on reported regulatory actions. Much of this information is provided by the participating agencies themselves. To a very limited extent, the ***Annual Report*** describes some of the exposure reductions associated with agency regulations.

The ***Annual Report*** has not attempted to identify regulatory "gaps"—areas where regulations appear to be needed—or to evaluate whether current standards are sufficiently protective. Instead, the ***Annual Report*** presents only descriptive information on the regulatory standards that have been issued.

Listed Chemicals

The first ***Annual Report*** listed only the 26 chemicals that IARC had determined to be human carcinogens. The second ***Annual Report*** listed 25 chemicals known to be carcinogenic based on human data[3] and 63 chemicals reasonably anticipated to be carcinogenic. The third ***Annual Report*** listed 22 chemicals known to be carcinogenic and 95 chemicals reasonably anticipated to be carcinogenic. In the fourth ***Annual Report,*** 29 chemicals are listed as human carcinogens and 119 as reasonably anticipated to be carcinogenic.

The fourth ***Annual Report*** lists 148 chemicals, chemical groups, mixtures, and exposures altogether. NTP has grouped these chemicals into 12 categories:

1. natural substances;
2. food or cosmetic additives;
3. pesticides;
4. drugs;
5. dyes, dye intermediates and pigments;
6. combustion products;
7. solvents;
8. metals and metal compounds occurring in mining, extraction, and refining processes;
9. analytical and research chemicals;
10. miscellaneous use chemicals;
11. various industrial chemicals and by-products; and
12. occupational exposures with unknown etiologic agents.

For this analysis, OTA has adjusted the total to eliminate double counting, yielding a total of 145.[4]

[3] IARC had r&valuated and reclassified Chloramphenicol, and for this reason, changes between the second and third reports, as well as between the third and fourth involve reevaluation of other **chem**icals by the committee compiling the ***Annual Report.***

[4] Specifica11y, this adjustment affects "nickel" and "nickel refining, " "Phenacetin" and "analgesic mixtures containing Phenacetin, " and "certain combined chemotherapy" with some chemotherapeutic agents. In the discussion below, the number of actions does not always add correctly to the total indicated, usually because some chemical has been addressed in several different ways.

Some well-known carcinogens have not been included in the ***Annual Report*** lists, although the introduction briefly mentions several of them: tobacco smoke, alcohol, ionizing radiation, viruses, and ultraviolet radiation (including sunlight). Additionally, though underground hematite mining is listed, underground uranium mining, which exposes workers to radon daughters, is not.

NTP uses the IARC lists of human and animal carcinogens as a source, but several agents and processes on the IARC list have not been listed by NTP. With regard to the IARC listing of exposures under Boot and Shoe Manufacture and Repair and Furniture Manufacture, the report states that, while NTP "does not disagree with these judgments," it does not list these processes because the particular causes or process steps associated with cancer in these cases have not been isolated. NTP also notes that these processes vary significantly among countries and have also changed, thus changing the nature of the exposures.

NCI/NTP CHEMICAL TEST RESULTS

Classification of Test Results

Through June 1, 1987, 308 different substances and mixtures have been tested in long-term animal bioassays sponsored by NCI and NTP. The number of studies totals 327; 17 chemicals have been studied twice and one (trichloroethylene) has been studied three times (85).

Published reviews of these studies summarize the results for the nearly 200 substances tested when the program was under NCI (30,32,73) and the just over 100 conducted since then under NTP (84,85,91,92).

In this analysis, NCI/NTP test results are grouped by the level of evidence for carcinogenicity that they provide and then Federal agency responses to these results through risk assessments and regulations are examined. The "level of evidence" is determined for each particular species and sex. Separate results are given for each "expediment, " that is, each combination of species and sex in a study: male rats, female rats, male mice, and female mice. Results of NCI-conducted bioassays and the early bioassays conducted by NTP were described in the technical reports as "positive, " "negative, " "equivocal, " and "inadequate." Since June 1983, NTP has used five categories for levels of evidence, using either "clear evidence" or "some evidence" for positive results. Thus, in the current NTP scheme, the results of each experiment are classified as clear evidence, some evidence, equivocal evidence, inadequate evidence, or no evidence of carcinogenicity (see ch. 2).

NTP test results are examined by peer review, with the reviewing committee classifying the results. Results are then published as technical reports and in summary form. NTP has not developed any general classification or ranking that considers the results of all experiments (for all sexes and species) together.

OTA Grouping of Test Results

OTA has used the most recent summary of results to classify the chemicals tested in NCI/NTP bioassays (85).[5] In that summary, each study was classified by the scheme in use at the time of the study, relying on the conclusions published in the study's technical report. While the summary covers all test results up to June 1987, OTA has included only those chemicals for which the technical report had been printed, or which had already been subject to peer review and data audit, as of the September 1986 NTP Management Status Report.

Table 5-1 summarizes the number of substances in each evidence category. In total, 284 chemicals were tested in 298 separate studies. [b] In this analysis, 13 chemicals have been tested twice and 1 three times. In most cases, each study represents four "experiments": male rats, female rats, male mice, and female mice. In some cases, hamsters were the second species tested; in a few cases, only

[5]OTA will refer to the chemicals tested by NCI/NTP that tested positive in at least one experiment as "positive NC1/NTP chemicals. "

[b]The number of studies here is fewer than that given above (306) because OTA'S cutoff date was September 1986, while for the review above the date used was June 1, 1987 (85).

Table 5-l.— Summary of NCI/NTP Test Results

Level of evidence	Number of tests	Number of chemicals (Grouping duplicate tests in highest level of evidence)
4 positive	38	36
3 positive	25	25
2 positive	55	51
1 positive	33	32
Total positive	151	144
Equivocal evidence	36	35
Inadequate test	11	9
All negative	100	96
Total	298	284

SOURCE Off Ice of Technology Assessment, 1987.

male and female animals of one species were tested.

For this analysis, OTA has grouped chemicals by the number of species and sex combinations that show a particular level of evidence. The first group consists of substances for which all four experiments showed positive results ("positive" for older tests, "clear evidence of carcinogenicity" or "some evidence of carcinogenicity" for later tests). The second group consists of chemicals testing positive in three of four experiments, that is, positive in both sexes of one species, but only one sex of the second species. The third group includes chemicals yielding two positive experiments: either positive results in both sexes of one species and equivocal evidence, inadequate evidence, or negative evidence in the second species, or positive results in a mixed fashion in two experiments (e.g., positive in male rats and female mice).' The fourth group covers chemicals with one positive experiment. Remaining test results are classified equivocal, inadequate, or negative ("no evidence"),

When a chemical has been tested more than once, values on the table represent the highest level of evidence for the chemical. For example, test results for tetrachloroethylene (perchloroethylene) were published in 1977 and 1986. The 1977 results were inadequate in male and female rats and positive in male and female mice. The 1986 results consisted of clear evidence in male rats, some evidence in female rats, and clear evidence in male and female mice. The first test results are considered two positives; the second test results as four. Thus, tetrachloroethylene was grouped with the other chemicals yielding four positive results. When counting the number of chemicals for the second column of table 5-1, multiple tests of the same chemical were counted only once.

As shown in table 5-1, using this method of grouping, 36 chemicals (as opposed to studies) yielded four positive results, 25 three positives, 51 two positives, and 32 one positive. Chemicals that failed to yield at least one positive experiment were not included in analyzing agency responses to test results. The total number of chemicals analyzed by OTA was thus 144. Of the 144, 61 chemicals tested positive in three or four experiments.

Some factors have not been incorporated in the present analysis: affected tumor sites in the animals, whether both high and low doses (or all three doses in a three-dose experiment) produced a response, or the estimated potency of chemicals. Also, the grouping of chemicals here is based solely on results of NCI/NTP tests. OTA has not used results from other animal bioassays or from epidemiologic studies.

[7]Because there is a high concordance of positive results within a species, a two-positive result in two species may be stronger evidence for carcinogenicity than a two-positive result in one species. For the chemicals analyzed by OTA, 8 of the 51 two-positive results are positive in two species. However, OTA has not analyzed these two kinds of two-positive results separately.

OTA ANALYSIS OF ACTIONS, EXPOSURES, AND AGENCY JURISDICTIONS

Agencies and Programs Analyzed

In this analysis, OTA covers the major agencies and programs authorized to regulate chemicals tested in NCI/NTP bioassays (EPA, FDA, OSHA, and CPSC), and two organizations with risk assessment responsibilities (NIOSH and EPA's Carcinogen Assessment Group (CAG)). EPA was analyzed by the following major program areas:

- hazardous air pollutants listed under section 112 of the Clean Air Act (CAA);
- chemicals covered by water quality criteria documents issued under the Clean Water Act (CWA);
- chemicals covered by interim drinking water standards issued and recommended and maximum contaminant levels (RMCLS and MCLS) proposed under the Safe Drinking Water Act (SDWA);
- pesticides canceled, regulated, or voluntarily removed from the market under the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA);
- chemicals evaluated, designated, or regulated under sections 4 and 6 of the Toxic Substances Control Act (TSCA);[8]
- chemicals listed as hazardous wastes and as hazardous constituents of wastes (Appendix VIII) by the Office of Solid Waste under the Resource Conservation and Recovery Act (RCRA);
- chemicals for which reportable quantities were established under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA); and
- chemicals assessed by the Carcinogen Assessment Group (CAG).

Determining Agency Actions on *Annual Report* Chemicals

The source for the discussion below on carcinogen regulation is the ***Annual Report*** itself.[9] Regulations on carcinogens that are based on noncarcinogenic effects are also covered in the discussion.

Determining Agency Actions on NCI/NTP-Tested Chemicals

To determine which tested chemicals have been subject to regulatory action, OTA sent a list of all chemicals tested in NCI/NTP bioassays to EPA, FDA, OSHA, and CPSC. OTA asked that they indicate which substances they had evaluated for carcinogenicity, which they had prepared a risk assessment for, which they had proposed to regulate, and which they had issued final regulations on. Federal agency responses were supplemented with information OTA gathered from other sources (see ch. 3).

Exposure Information

The present analysis faced one particularly difficult and important problem—determining exposures. Not every chemical tested by NCI/NTP is actually in commerce, and some have never been in commerce. Some are trace contaminants, chemical byproducts, or intermediates in closed industrial chemical processes, to which exposures may be limited. Others are found in consumer products and foods at relatively low concentrations, but because millions of people are exposed, the potential for harm may be great. Other substances analyzed here may be found in ambient air, surface water, or drinking water supplies.

Which agencies and programs (or statutes) should be concerned about a chemical depends on the nature and extent of exposure. Unfortunately, comprehensive data on toxic chemical exposures do not exist. For example, data on particular environmental media (e.g., drinking water) derive from studies measuring the concentrations of particular chemicals (e.g., EPA's 126 priority water pollutants), studies which of course do not determine the presence of all chemicals of interest.

Lacking information on exposures, agencies frequently use chemical production data to set priorities. To obtain such production data, OTA searched the Hazardous Substance Data Bank (HSDB) of TOXNET, a database maintained by NLM, which includes information on production levels estimated by the Stanford Research Institute (SRI).

While the SRI data on chemical production are frequently used, they also have limitations. First, SRI has not made production volume estimates for every chemical of interest in this analysis. Second, HSDB does not provide any information at all on some chemicals included in this analysis. (Even if SRI had prepared estimates in these cases,

[8]TSCA Interagency Testing Committee recommendations and EPA-issued test rules have been excluded.

[9]Throughout this discussion, references to the ***Annual Report*** are to the fourth report. OTA will refer to the chemicals as ***"Annual Report*** chemicals. "

OTA was not able to use those estimates because the information was not contained in HSDB.) Third, production level is an imperfect proxy for what is really at interest—the actual levels of exposure. For example, a chemical can be produced and consumed in a closed system with relatively little exposure to workers or the environment. Production volume statistics by themselves do not reflect such situations. Nonetheless, production volume is frequently the only information available and is often used when describing and ranking the potential risks of different chemicals.

OTA also obtained information from the NIOSH-conducted National Occupational Hazard Survey (1972-74) and its update, the National Occupational Exposure Survey (1981-83). These surveys present the results of walk-through observations of chemicals found in workplaces representing the manufacturing and public utility sectors.

OTA also asked each agency to indicate which chemicals might be present in those media or exposure situations of interest to the agency. OTA used information on production volumes, potential worker exposures, uses of chemicals, and agency responses to narrow the list of chemicals for each agency or program to the chemicals of potential regulatory interest. This information was used to define a regulatory jurisdiction for each agency or program. In addition, OTA automatically included in an agency's jurisdiction those chemicals that the agency has already acted on.

Regulatory Jurisdictions

In all cases, a chemical is included in the OTA-defined jurisdiction for an agency or program if the agency or program has already acted on that chemical. OTA supplemented this with other information to define the agency jurisdictions for chemicals they have not acted on.

FDA actions were analyzed in the following categories: 1) chemicals evaluated, regulated, or banned in foods, color additives, and cosmetics; 2) animal drugs; and 3) human drugs. Regulatory jurisdiction was based on information on chemical uses and responses from FDA staff concerning chemicals FDA had evaluated.

OSHA's and NIOSH's jurisdictions were defined based on whether a chemical was detected in the NIOSH occupational hazard and ***exposure*** surveys or is produced in quantities greater than 1 million pounds annually. OTA did not make distinctions based on the number of employees potentially exposed because that information is either fairly old (deriving from the 1972-74 survey) or still incomplete (data from the 1981-83 survey do not yet cover exposures to trade name products).

To determine a regulatory jurisdiction for CPSC, OTA obtained its staff's indications on the identities and levels of chemicals present in consumer products and on which chemicals present actual or possible consumer exposures.

For hazardous air pollutants, EPA has compiled a database on chemicals of interest and specified methods and developed a computer program for ranking pollutants. This system is called the Modified Hazardous Air Pollutant Prioritization System (MHAPPS) (167). OTA did not use the EPA priority-setting computer program. Rather, OTA searched the MHAPPS database of 609 chemicals for the positive NCI/NTP and ***Annual Report*** chemicals and for chemicals that were produced in quantities exceeding 1 million pounds per year with either of the following characteristics:

- a vapor pressure > 100 mm Hg or a boiling point < 80° C, or
- a vapor pressure > 24 mm Hg and <100 mm Hg or a boiling point > 800 C and < 100° **C.**

These characteristics are those specified by MHAPPS methods (167). The vapor pressure and boiling point criteria were used to narrow attention to the most volatile chemicals. While dusts, such as those of arsenic or chromium, may also present problems as hazardous air pollutants, they were not included in this analysis,

To define the jurisdiction for EPA administration of the Clean Water Act, OTA used information from an EPA database—the Historical Fre-

[10] A banned chemical will no longer be in production and thus would not be within a regulatory jurisdiction defined exclusively by production data. In such a case, the chemical would still be included in the regulatory jurisdiction by OTA analysis,

quency Database—prepared for EPA's Effluent Guidelines Division, with water samples collected from 1976 to 1979 and computer data entry from 1977 to 1981. That a chemical is in the database indicates it was detected in effluent streams associated with discharges into surface water. That a chemical is not included in the database does not necessarily indicate that it is not a potential water pollutant, only that it was not detected using a particular set of methods and water samples. The chemical's being present in the database, on the other hand, indicates that it is a potential pollutant in at least some locations (113).

To analyze actions on drinking water, OTA requested information from the staff of EPA's Office on Drinking Water on positive NCI/NTP chemicals and ***Annual Report*** chemicals known to be present or that might be present in drinking water. In addition, EPA staff indicated which chemicals on these two lists had been detected in drinking water, but at levels that they judged "not significant" (36).

For information on pesticides, OTA asked staff of the EPA pesticide program to indicate which chemicals on the two lists were used as active ingredients and inert ingredients in pesticides (21).

TSCA's jurisdiction is all toxic chemicals. Under TSCA, regulatory treatment differs if a chemical is in commerce or is not in commerce. Therefore, distinctions were made between chemicals that are produced in large quantity (more than 1 million pounds annually), produced in smaller quantity (less than 1 million pounds), not produced, or have unknown status because there were no entries on them in HSDB.

The regulatory jurisdictions for RCRA and CERCLA for this analysis are ***Annual Report*** and positive NCI/NTP chemicals.

Table 5-2 summarizes, by level of evidence, the number of positive NCI/NTP chemicals that have been acted on by the various agencies and programs.

Review of OTA Analysis

A first draft of this analysis was sent to the agencies in February 1987 in preparation for an OTA workshop in March 1987, to which agency staff and representatives of other groups were invited. Again, agencies were asked to indicate which of the ***Annual Report*** and NCI/NTP chemicals they had acted on and to provide information on regulatory jurisdictions. A second draft was sent to the agencies in May 1987, again requesting comments and providing an opportunity for errors to be corrected.

RESULTS OF OTA ANALYSIS

FDA Actions on Foods and Cosmetics

Annual Report Chemicals

Two ***Annual Report*** chemicals are in its category "food or cosmetic additives." But a number of chemicals in other ***Annual Report*** categories contaminate food or cosmetic additives or are considered indirect additives. These chemicals have also been acted on or evaluated by FDA. As described in chapter 3, the major types of materials FDA evaluates for potential hazards in foods and cosmetics are direct food additives, indirect food additives, color additives, other ingredients in cosmetics, and unavoidable environmental contaminants in food.

A few ***Annual Report*** chemicals are or were direct food additives: safrole and cadmium have been banned as additives to food (though the action taken on cadmium was not based on its carcinogenicity). FDA proposed to ban saccharin, but Congress acted to prevent the ban. Two more ***Annual Report*** chemicals, nitrilotriacetic acid and hydrazine, are added to boiler water and are considered secondary direct additives. FDA has not banned their use, but instead has set regulations specifying the safe use of these substances.

Fifteen ***Annual Report*** carcinogens are indirect food additives or were considered potential indirect additives. Indirect additives are usually substances that may migrate into food from packag-

Table 5.2.—Agency Actions on Positive NCI/NTP Chemicals

	Level of evidence				
	Four positives	Three positives	Two positives	One positive	All positive NCI/NTP chemicals
Number of chemicals	36	25	51	32	144
No activity	13	10	12	8	43
CAG assessment	6	3	11	2	22
RCRA listed or App. VIII	14	8	17	2	41
CERCLA					
Listed	14	8	19	6	47
Proposed RQ adjust.	11	4	15	2	32
CWA WQC or standards	6	1	5	2	14
SDWA					
Interim std. (1975 and 1979)	—	1	1	—	2
Proposed and final RMCL	5	—	5	1	11
CAA listed	1	—	—	1	2
TSCA					
Rule 8a or 8d or CHIP	14	8	20	11	53
4(f) review/SNUR/Sec. 6	2	—	2	1	5
FIFRA					
Susp. Cane.	2	—	6	1	9
Vol. Cane.	2	1	—	1	4
Food and Cosmetics (Ban, SUR, or action level)	4	3	7	3	17
FDA					
Animal drugs (revoked/withdrawn)	—	1	2	1	4
Human drugs (labeled/withdrawn)	3	2	—	1	6
NIOSH recommendation	11	2	15	3	31
OSHA					
Noncancer std.	11	4	10	2	27
Cancer std.	1	—	—	1	2
CPSC					
Ban/restricted	2	—	—	1	3
Voluntary reduction only	2	—	3	—	5

SOURCE Office of Technology Assessment, 1987

ing material. FDA prohibited the use of materials that contain three of these substances (4,4'-methylenebis (2-chloroaniline), ethylene thiourea, and 2,4-diaminotoluene). FDA proposed to ban the use of three other chemicals (hydrazine, 2-nitropropane, and chloroform [in food contact articles]), but final action was never taken.

For five ***Annual Report*** chemicals considered potential indirect additives, FDA chose not to ban the packaging materials, but issued rules for safe use of the material (1,2 -dichloroethane, dimethyl sulfate, Epichlorohydrin, toluene diisocyanate, chromium [though the last was not for carcinogenicity]). Two ***Annual Report*** carcinogens, acrylonitrile and vinyl chloride, may migrate from certain plastic bottles. In the 1970s, FDA proposed to prohibit use of these bottles.[11] In the 1980s, FDA took action to permit their use. It is currently evaluating the risks presented by another two potential indirect additives (di(2-ethylhexyl)phthalate (DEHP)and4,4'-methylenedianiline [MDA]).

Fifteen other Annual Report chemicals contaminate direct food or color additives. Urethane is a contaminant of diethylpyrocarbonate (DEPC), which was banned. Benzidine, 4-aminobiphenyl, 2-naphthylamine, o-toluidine, and polycyclic aromatic hydrocarbons contaminate various color

[11] Although at the time, FDA was not regulating acrylonitrile as a suspect carcinogen. Their action to prohibit this particular bottle was overturned in court.

additives.[12] As described in chapter 3, FDA has changed the approach it takes when a color additive is contaminated with carcinogenic impurities. Prior to 1982, FDA banned several such additives. After 1982, following its new policy on impurities, FDA has permitted these color additives.

In evaluating other cosmetic ingredients, FDA has banned the addition of chloroform to cosmetics and allows the use of lead acetate, 2,4-diaminoanisole sulfate, and 4-chloro-o-phenylenediamine in hair dyes. It has set a limit, however, on the amount of lead acetate permitted in these dyes. For the other two chemicals, FDA had attempted to require a product warning label on coal tar dyes. This requirement was stayed by court order. FDA has not taken action to reinstate the warning label.

Finally, with regard to environmental contaminants, FDA has set food tolerances for polychlorinated biphenyls (PCBs) and action levels for 15 ***Annual Report*** chemicals, including aflatoxins, several pesticides (DDT, ethylene dibromide, Kepone, Mirex, Toxaphene), polybrominated biphenyls, and cadmium (though this FDA action was not based on carcinogenicity). FDA is also currently considering a petition to reduce permissible levels of urethane (a product of the fermentation process) found in wine and other alcoholic beverages.

Considering all FDA activities together and eliminating double counting of chemicals yields a total of 52 different ***Annual Report*** carcinogens examined by FDA. Of these, 9 individual chemicals and one group of 10 chemicals, polycyclic aromatic hydrocarbons (PAHs), are associated with materials banned by FDA. Twelve chemicals are associated with materials FDA has issued safe use rules on or has permanently listed (as permissible color additives), and three ***Annual Report*** chemicals are permissible ingredients in hair dyes. For 16 chemicals, tolerances or action levels have been set. Some carcinogens in the ***Annual Report*** are subjects of proposed bans that were never finalized. FDA is still evaluating at least three (DEHP, MDA, and urethane in alcoholic beverages).

Of the 52 chemicals, 46 have been subject to final FDA actions consisting of bans, safe use rules, permanent listing decisions, or the setting of tolerances or action levels. Ten chemicals have not been subject to final actions, although sometimes this lack of action concerns only some uses.[13]

Excluding environmental contaminants, 37 chemicals are associated with food or color additives, and potentially subject to bans under provisions of the Food, Drug, and Cosmetic Act. Of these, 19 (including 10 PAHs) are associated with materials actually banned by FDA. For most of the remaining chemicals, FDA has specified safe use rules.

Positive NCI/NTP Chemicals

Most of the bioassay information evaluated by FDA for food and cosmetic ingredients is obtained from testing FDA requires from the ingredients' sponsors. In a few cases, direct food or color additives or potential indirect additives have been tested by NCI/NTP. More frequently, the NCI/NTP bioassay program has tested chemicals that may be present as impurities in additives or cosmetics.

FDA actions on positive NCI/NTP chemicals may be broken down based on the use of the material. One direct food additive has been banned (cinnamyl anthranilate). Currently pending is a proposed safe use rule to allow use of methylene chloride to decaffeinate coffee. FDA has also proposed to ban use of trichloroethylene for coffee decaffeination and cosmetic uses. Although that proposal was never issued in final form, those uses of trichloroethylene have apparently stopped.

One color additive, D&C Red No.9, is in the group of 144 positive test result chemicals, having tested positive in male rats. As described in chapter 3, FDA has permanently listed this color additive.

12 FDA has not determined which of the 10 polycyclic aromatic hydrocarbons listed in the ***Annual Report*** actually contaminated carbon black and graphite, the colors in question. For simplicity, all are included in this discussion.

13 Hence these chemicals total 52 because several chemicals are in both groups.

FDA has taken some action on three positive NCI/NTP chemicals that are potential indirect additives. It has proposed to ban chloroform from food contact materials. Safe use rules have been issued for 1,4-dioxane and 1,1, 2-trichloroethane.

Safe use rules have also been issued for three contaminants of color additives: aniline hydrochloride, azobenzene, and CI Vat Yellow No.4.

Ten other positive NCI/NTP chemicals have or had cosmetic uses. One has been banned from cosmetics (chloroform); FDA has proposed banning one other from cosmetics (methylene chloride). Seven positive NCI/NTP chemicals are used in hair dyes (2,4 -diaminoanisole sulfate, 4-chloro-m-phenylenediam ine, 4-chloro-o-phenylenediamine, 2-nitro-p-pheny ~enediamine, 4-amino-2-nitrophenol, HC Blue No.1, and 2,4-diaminotoluene). These dyes are all currently permitted. As mentioned above, FDA acted to require a warning label for coal tar hair dyes, but that requirement was overturned by court order. In addition, selenium sulfide is allowed for use in dandruff shampoo.

Action levels or food tolerances have been issued for eight positive NCI/NTP chemicals.

Considering these FDA actions together and eliminating double counting yields a total of 17 positive NCI/NTP chemicals on which FDA has taken some final action; for 2 other chemicals it has proposed action. A greater number of positive NCI/NTP chemicals, 31, have only been evaluated by FDA. These include 9 chemicals with four positive results, 3 with three positives, 10 with two positives, and 9 with one positive result. The evaluations include exposure assessments and risk assessments, which were conducted because FDA thought that the chemicals might be found in food additives or cosmetics.

The scope of FDA jurisdiction is thus 48 positive NCI/NTP chemicals. Of these, 19 had three or four positive experiments. FDA has issued final bans, safe use rules, or action levels or tolerances for seven of these.

FDA Actions on Human Drugs

Annual Report Chemicals

Thirty-four ***Annual Report*** chemicals have or had uses as human drugs. Thirty-one of these are listed in the ***Annual Report*** as "drugs." Several of these listings, however, may represent double counting: "phenacetin" and "analgesic mixtures containing phenacetin" are listed separately, and "certain combined chemotherapy for lymphomas" overlaps with the listing of specific drugs included in those therapies. For this discussion, therefore, OTA will count 29 chemicals as "drugs." In addition, five chemicals have or had drug uses, or might be found in drug products, but are listed in different categories: thorium dioxide (listed under "miscellaneous uses"), chloroform (listed under "solvents"), coal tar (listed under "occupational exposure with unknown etiologic agent"), urethane and vinyl chloride (both listed under "industrial chemicals and byproducts").

Of the 29 chemicals listed as "drugs," 25 are on the market with physicians' labeling information warning of carcinogenic effects, 2 have been removed from the market or were never approved (Phenacetin) and (Chlornaphazine), and 2 are approved drugs on the market (selenium sulfide and Propylthiouracil). Selenium sulfide is approved for use in dandruff shampoos and for topical treatment of fungal infections. The labeling in this case only indicates the negative results of skin-painting experiments in mice. There is no labeling information on propylthiouracil in the ***Physician Desk Reference.***

The remaining five chemicals in nondrug categories are the following:

1. Thorium dioxide, which FDA approved for x-ray imaging, although labeling restricts use to patients with limited life expectancy.
2. Chloroform, for which FDA banned drug uses in 1976.
3. Coal tar, which has medical use as a topical antifungal agent and in the treatment of psoriasis. It was declared to be unsafe for over-the-counter use by an FDA advisory panel in 1982. The final monograph on this decision is still being prepared for publication.

4. Urethane, which was removed from the market in 1970 because it was determined to be ineffective as a drug.
5. Vinyl chloride, for which FDA announced that a new drug application would be required for drug use to be permissible.

Thus there are 34 ***Annual Report*** chemicals with drug uses: 5 were removed from the market or never approved, *26* are approved for use but with the physicians' labeling information warning of potential carcinogenic effects, 2 were approved for topical use, and 1 was approved for use without any labeling information available.

Positive NCI/NTP Chemicals

Twelve positive NCI/NTP chemicals were indicated to be used in drugs, many as anticancer agents. All drugs are permitted to be on the market by virtue of some FDA regulatory action (e.g., through approval of a new drug application in the case of new drugs). But for this analysis, the actions of interest are regulatory and directed toward the carcinogenic risk that may be presented by these drugs. Thus only actions to remove a drug from the market, restrict its uses, or require warning labels are considered as regulatory actions. By this standard, two positive NCI/NTP chemicals have been regulated: chloroform was banned from drugs, and FDA required physician labeling for Reserpine (three positives) to warn of animal carcinogenicity. Physician labeling fors of the 11 remaining drugs warns of potential carcinogenicity. The final *6* drugs are not included in the latest edition of the ***Physician's Desk Reference*** and may never have gotten past the investigational stage. All were intended for use as anticancer drugs. Finally, although it is not a drug, DEHP, which is used to make blood bags, may migrate from those bags into the blood stored inside.

FDA Actions on Animal Drugs

Annual Report Chemicals

Six ***Annual Report*** chemicals are used as drugs for food-producing animals. FDA revoked approval for one of these— diethylstilbestrol (DES)– while for a second, Reserpine, the sponsor withdrew the application for approval. The remaining four substances and classes of substances—conjugated estrogens, nonconjugated estrogens, progesterone, and iron dextran complex—may be used in animals.

Positive NCI/NTP Chemicals

Five positive NCI/NTP chemicals have uses as animal drugs or are related to animal drugs. FDA has revoked approval for four of these. The fifth chemical, Zearalenone, is related to the animal drug Zeranol. Thus far, no action has been taken on Zeranol.

OSHA

Annual Report Chemicals

OSHA regulates exposures to *52* ***Annual Report*** chemicals, although for 35 of these chemicals, the standards were based on noncarcinogenic effects and were adopted as "startup" standards 15 years ago. These standards may not be sufficiently protective when potential carcinogenicity is considered. OSHA has issued "permanent" standards based on carcinogenicity for 17 ***Annual Report*** chemicals. Ten of these were part of the "14-carcinogen standard" issued in 1973, while the remaining 7 chemicals were regulated individually. One of these, asbestos, has been the subject of two different "permanent" standards. Two of OSHA's permanent standards were overturned by the courts. One of these (regulation of benzene) is currently the subject of a new proposal. In the meantime, however, the old startup standard continues to be used. The other (4,4' -methylene bis (2-chloroaniline)) never had a startup standard and is currently unregulated. New standards have been also proposed for two more ***Annual Report*** chemicals, formaldehyde and ethylene dibromide (EDB).

As mentioned above, OSHA is also using the ***Annual Report*** as part of its hazard communication standard. While this information will be valuable to employers and employees, it does not replace the need for standards that set exposure limits and require controls. OSHA itself is considering regulatory action on several ***Annual Report*** chemicals. The actions summarized here are only OSHA regulatory actions that set exposure limits or control requirements.

While OSHA has exposure standards and requirements, based on either carcinogenic effects or other toxicities, for 52 ***Annual Report*** chemicals, it has no exposure standards of either type for the other 93 ***Annual Report*** chemicals. These unregulated chemicals and the 35 chemicals with startup standards based on noncarcinogenic toxicities gives a total of 128 ***Annual Report*** chemicals that OSHA does not regulate for carcinogenicity.

Not all of these 128 chemicals are currently produced or used in the United States. Using the OTA-defined OSHA jurisdiction (potential worker exposure detected in NIOSH occupational surveys or production volume greater than 1 million pounds), 58 of the 93 ***Annual Report*** carcinogens lacking standards and 25 of the 35 with startup standards are of regulatory concern to OSHA. Thus, the OSHA jurisdiction includes 83 of the 128 ***Annual Report*** chemicals that lack standards based on carcinogenicity.

Considered another way, OSHA has issued standards based on carcinogenicity for 17 ***Annual Report*** chemicals and noncancer standards for another 35. Fifty-eight ***Annual Report*** chemicals lacking standards are in the OSHA jurisdiction. The total OTA-defined jurisdiction is ***110 Annual Report*** chemicals.

Positive NCI/NTP Chemicals

As mentioned above, OSHA has issued permanent standards related to carcinogenicity for 2 of the 144 positive NCI/NTP chemicals—asbestos and 1,2-dibromo-3-chloropropane (DBCP). Neither of these actions, however, was based primarily on the NCI/NTP test results: asbestos is a human carcinogen, and DBCP was regulated by OSHA primarily because it caused sterility in male workers, although the NCI carcinogenicity data were available and were considered by OSHA when it set the standard.

Two other positive NCI/NTP chemicals have been proposed for new standards—benzene and EDB. Benzene had been the subject of a final standard in 1978 based on human evidence, but the standard was overturned by the courts. OSHA issued a proposal for EDB in *1983*, but no standard has been issued in final form, although most pesticide uses of EDB were canceled by EPA in 1984.

EDB has actually been tested twice by NCI/NTP. The first results, positive in all four experiments using gavage exposure, were published in 1978, while the second results, positive in all four experiments in an inhalation study, were published in 1982. OSHA still has not issued a standard. In explaining its "cancer policy, " OSHA described a bioassay result that it should not ignore, even if the test results were based on high doses:

> Those who would urge OSHA to reject data from tests conducted at "too toxic" doses would presumably wish OSHA to ignore data such as those on 1,2-dibromoethane [ethylene dibromide], which induced multiple-site tumors at both dose levels in both sexes of rats and mice within 60 weeks of exposure, at incidence rates up to 94 percent. . . . OSHA believes that it would be improper to ignore such overwhelming evidence of hazard (274).

This quotation refers to the 1978 NCI results.

Twenty-seven of 144 positive NCI/NTP chemicals (19 percent) are currently regulated under the OSHA startup standards based on noncarcinogenic toxicity. These include 15 among the 61 with three or four positive results (25 percent).

Some positive NCI/NTP chemicals are not present in the workplace in substantial quantities. As explained above, to develop a jurisdiction of chemicals of regulatory interest, OTA used information for chemical production and detection in the NIOSH surveys. Using these criteria, 17 of the 27 positive NCI/NTP chemicals currently regulated with startup standards are of potential regulatory interest to OSHA. Twelve of these have positive results in three or four experiments. As mentioned above, proposals are pending for two of these.

A total of 115 of the 144 positive NCI/NTP chemicals have no occupational exposure standard.[14] Of the 115 chemicals, 24 are in the OTA-defined OSHA regulatory jurisdiction. Forty-five

[14] "Although positive test results may trigger coverage under standards for labeling and access to medical records.

of the 144 positive NCI/NTP chemicals were positive in three or four experiments. Of these, 14 are in OSHA'S jurisdiction.

Considered another way, OSHA has noncancer standards for 27 positive NCI/NTP chemicals and carcinogenicity standards for 2. An additional 24 chemicals were positive in NCI/NTP bioassays and are in OSHA'S jurisdiction, but have no occupational standard of either sort. Limiting attention to the chemicals that tested positive in three or four experiments, OSHA has noncancer standards for 15 chemicals and a carcinogenicity standard for 1 more. An additional 14 chemicals with three or four positive results are in OSHA'S jurisdiction, but have no OSHA standards.

NIOSH

Annual Report Chemicals

NIOSH has prepared recommendations to OSHA for 59 ***Annual Report*** chemicals. For 18 of these, OSHA has issued standards based on carcinogenicity, although two of these standards were struck down by the courts (those for benzene and 4,4'-methylene bis (2-chloroaniline)). OSHA has proposed a new standard for benzene and for two additional ***Annual Report*** chemicals on which there are NIOSH recommendations (formaldehyde and EDB). In all, there are 20 chemicals with NIOSH recommendations for which OSHA has either proposed or issued standards for carcinogenicity. The remaining 39 chemicals include 24 covered by startup standards, which as already mentioned, were not based on carcinogenicity, and 15 currently lacking an OSHA standard.

NIOSH has not issued recommendations for 86 ***Annual Report*** chemicals. In this case, once again, not all of these chemicals are produced or present potential worker exposures. Based on the OTA-defined jurisdiction, 53 of the 86 chemicals lacking NIOSH recommendations are produced in quantities greater than 1 million pounds or were detected in the NIOSH occupational surveys and thus may present worker exposures.[15]

[15]OTA defined th, NIOSH jurisdiction to include chemicals detected in NIOSH'S occupational surveys as well as chemicals with annual production volume greater than 1 million pounds. The NIOSH and OSHA jurisdictions differ slightly because there are several chemicals that NIOSH has made recommendations on, but that do not satisfy any of the criteria for the OSHA jurisdiction.

Positive NCI/NTP Chemicals

NIOSH recommendations cover 31 of the 144 positive NCI/NTP chemicals (22 percent). NIOSH recommendations cover 13 of the 61 chemicals that tested positive in three or four experiments (21 percent). There are 113 positive NCI/NTP chemicals for which NIOSH has not issued recommendations, including 48 three- and four-positive results. Thirty-one of the 113 positive NCI/NTP chemicals and 22 of the 48 chemicals with positive results in three or four experiments are in the OTA-defined jurisdiction for NIOSH.

CPSC

Annual Report Chemicals

CPSC reported regulatory activity or voluntary control for 18 ***Annual Report*** chemicals. These include four chemicals banned from consumer products—carbon tetrachloride, tris(2,3-dibromopropyl)phosphate (tris), certain uses of asbestos, and vinyl chloride used as an aerosol propellant. In addition, for asbestos, a proposed ban of use in consumer hair dryers led to voluntary control. CPSC attempted to ban urea-formaldehyde foam insulation (UFFI) to prevent consumer exposures to formaldehyde from this source. This action was subsequently overturned by the courts, although use of UFFI has apparently ceased. In addition, products containing more than 1 percent formaldehyde must bear a label warning of irritation associated with formaldehyde.

Benzene products were already covered by a labeling requirement when the issue of their carcinogenicity was raised. After a ban of benzene in all consumer products (except gasoline) was proposed, the use of benzene in these products stopped. Exposures to lead acetate and lead phosphate (listed as ***Annual Report*** carcinogens, but grouped as one chemical) are indirectly regulated through CPSC limits on lead in paint. For five dyes related to benzidine and found in artist materials, the hazard was voluntarily reduced. Levels of six different N-nitroso compounds were restricted in children's pacifiers.

To define a regulatory jurisdiction, OTA asked CPSC staff to provide information on the occurrence of ***Annual Report*** chemicals in consumer products. Based on this information, 34 ***Annual***

Report chemicals are present in consumer products for which no CPSC regulatory actions have been taken. Five of these are believed to present actual or possible consumer exposure—arsenic and arsenic compounds, chromium and chromium compounds, DEHP, 1,2-dichloroethane, and thiourea.

Limiting attention to chemicals believed to present actual or possible consumer exposures or that CPSC has already acted on yields a total of *24* chemicals in the OTA-defined CPSC jurisdiction. Eighteen of these have been subject to CPSC regulatory action or voluntary reductions or controls.

Positive NCI/NTP Chemicals

CPSC has addressed eight positive NCI/NTP chemicals. Three of these were the focus of some regulatory activity: tris (four positives) was banned from children's sleepwear, benzene (four positives) was voluntarily removed from consumer products after a proposed ban, and several consumer product uses of asbestos (one positive) were eliminated (through bans and voluntary actions). But again, all actions on benzene and asbestos were based on human evidence, not NTP bioassay results.

Five chemicals were subjects of some voluntary actions, for one of which a proposed labeling requirement is also pending. CPSC reports manufacturers voluntarily stopped using three different dyes (all yielding two positives) in consumer products. CPSC convened a chronic hazard advisory panel on DEHP (four positives) to consider regulatory action, but DEHP was voluntarily removed from children's pacifiers. CPSC has proposed that methylene chloride (four positives) be labeled a hazardous substance and has achieved some voluntary reductions in the use of this chemical in consumer products.

Among the *144* positive NCI/NTP chemicals, *65* are present in consumer products. Among these *65, 13* present what CPSC determines to be "actual or possible" consumer exposure.

Defining the CPSC jurisdiction to be those chemicals that present actual or possible exposures or that have been acted on by CPSC yields 14 positive NCI/NTP chemicals. Eight of these have been the subjects of CPSC regulations or voluntary reductions. Seven of the 61 NCI/NTP chemicals with three or four positive experiments fall in this CPSC jurisdiction. Four of these have been the subjects of CPSC regulations or voluntary reductions.

EPA Actions Under the Clean Air Act

Annual Report Chemicals

Six *Annual* ***Report*** chemicals have been listed as hazardous air pollutants, although the listing of one (beryllium) was based on noncarcinogenic effects. Emissions standards have been issued for five of the six listed (asbestos, beryllium, vinyl chloride, benzene, and arsenic), although proposed standards for benzene are still pending for other industries. Coke oven emissions standards have recently been proposed, but are not yet final. EPA has announced the "intent to list" five other ***Annual Report*** carcinogens: carbon tetrachloride, chloroform, chromium, cadmium, and ethylene oxide.

OTA defined a regulatory jurisdiction for EPA's regulation of hazardous air pollutants using information in the EPA-compiled MHAPPS database. Narrowing the jurisdiction to chemicals currently produced in quantities greater than 1 million pounds, OTA has selected the ***Annual Report*** carcinogens with relatively high vapor pressures, those greater than 100 mm Hg, and with vapor pressures between *24* and 100 mm Hg. The *Annual* ***Report*** carcinogens with relatively high volatility (vapor pressure greater than 100 mm Hg) are vinyl chloride, acrylonitrile, ethylene oxide, chloroform, and formaldehyde. One of these five (vinyl chloride) has been listed and regulated. Ethylene oxide and chloroform have been placed in the "intent to list" category. EPA has announced a plan to give local governments responsibility for addressing acrylonitrile exposures.

The ***Annual Report*** chemicals with lower volatility (vapor pressure between *24* and 100 mm Hg) and production greater than 1 million pounds are benzene, carbon tetrachloride, and 1,4-dioxane. One of these three chemicals (benzene) has been listed, and a second (carbon tetrachloride) is in the "intent to list" category.

The total jurisdiction in this case is 15 chemicals, consisting of the 8 chemicals above and 7

others that EPA has listed or has announced an intent to list. Of the 15, 6 have been listed.

Positive NCI/NTP Chemicals

Two NCI/NTP chemicals have been acted on under the Clean Air Act, although several more have been subject of pre-regulatory evaluations. Two NCI/NTP chemicals have been listed—benzene and asbestos—although both decisions to list were based on human evidence for carcinogenicity and were made before NCI/NTP test results were available. For six others, EPA has announced an "intent to list" (l,2dichloroethane, tetrachloroethylene, chloroform, 1,3-butadiene, trichloroethylene, and methylene chloride).

Chloroform, 1,3-butadiene, methylene chloride, and 1,2-propylene oxide are chemicals within the OTA-defined jurisdiction because they occur in the MHAPPS database, have a production volume greater than 1 million pounds, and have a vapor pressure greater than 100 mm Hg. EPA has announced an intent-to-list decision for three of these four chemicals. NCI/NTP chemicals produced in volumes greater than 1 million pounds, but with lower vapor pressures (between *24* and 100 mm Hg) are benzene, 1,4-dioxane, ethyl acrylate, trichloroethylene, l,2-dichloropropane, and 1,2-dichloroethane. Regarding these six chemicals, EPA has listed one, and announced its intent to list another.

Considering these chemicals along with those EPA has already listed or those it has announced its intent to list, and eliminating the double counting, yields a jurisdiction in this case of 12 positive NCI/NTP chemicals. Two of these have been listed. Limiting attention to positive NCI/NTP chemicals with three or four positive experiments, the jurisdiction is eight chemicals, of which one has been listed.

EPA Actions Under the Clean Water Act

Annual Report Chemicals

Under the Clean Water Act, water quality criteria documents have been issued for 47 ***Annual Report*** chemicals. During the 1970s, toxic effluent standards were issued for five of these chemicals. But, as discussed in chapter *3*, the "Flannery decree" replaced EPA development of toxic effluent standards with the use of technology-based effluent limitations, which are now used to regulate chemicals covered by the water quality criteria documents. In addition, discharges from the rubber industry (an ***Annual Report*** "chemical") are also regulated, although there is no specific water quality criteria document for this industry.

Beyond these *48* regulated chemicals, EPA's database shows that another 17 chemicals detected in effluent streams have not been regulated. Thus, the OTA-defined jurisdiction for the EPA clean water program is 65 chemicals.[16]

Positive NCI/NTP Chemicals

Water quality criteria documents under the Clean Water Act that consider carcinogenicity cover 14 chemicals from positive NCI/NTP bioassays, 7 with three- and four-positive results. Toxic effluent standards were issued for two of these chemicals—p,p'-DDE (related to DDT) and Toxaphene—although both actions took place prior to publication of NCI/NTP test results. All 14 chemicals are covered by technology-based standards because they are included in the list of *65* chemicals under the Clean Water Act.

In addition to the 14 positive chemicals covered by water quality criteria documents, EPA's database of chemicals detected in effluent streams shows another 13 positive NCI/NTP chemicals that have not been regulated. These include two chemicals with four positives, one with three positives, seven with two positives, and three with one positive. Thus, the OTA-defined jurisdiction of positive NCI/NTP chemicals for the clean water program includes a total of *27* positive test results. Fourteen of these 27 (52 percent) are covered in the water quality criteria documents that have been issued to date.

16By coincidence, this equals the number of classes of priority Pollutants. But the actual overlap is limited to 47 chemicals plus the rubber indust~.

EPA Actions Under the Safe Drinking Water Act

Annual Report Chemicals

Annual Report chemicals regulated in some way under the Safe Drinking Water Act include seven covered by interim standards: arsenic, cadmium, chromium, lead compounds (lead acetate and lead phosphate[17]), Lindane, Toxaphene, and chloroform. The first four of these, however, were not regulated for carcinogenic effects.

In the current process of setting standards, 11 ***Annual Report*** chemicals have been the subjects of proposed recommended maximum contamination levels (RMCLs): six standards were based on carcinogenicity for DBCP, EDB, Epichlorohydrin, Lindane, PCBs, and Toxaphene), while the remaining five were not (for arsenic, asbestos, cadmium, chromium, and lead compounds). For four more ***Annual Report*** carcinogens final RMCLs and final maximum contamination levels (MCLs) have been issued: benzene, carbon tetrachloride, 1,2-dichloroethane, and vinyl chloride.

For 19 ***Annual Report*** chemicals, EPA has issued health advisories. Of these chemicals, 14 are covered by interim standards or the current RMCL/MCL process. For the remaining five chemicals (1,4-dioxane, ethylene thiourea, hexachlorobenzene, nickel, and 2,3,7,8-tetrachlorodibenzo-p-dioxin), only the nonbinding health advisories have been issued.

To define a regulatory jurisdiction, OTA requested that the EPA Office of Drinking Water Standards indicate which ***Annual Report*** chemicals are found in drinking water and which present significant exposures. The office indicated that 120 of the chemicals in the ***Annual Report*** had been detected in drinking water. Of these, 31 were estimated to present significant human exposures, including 9 of the 10 polycyclic aromatic hydrocarbons. Finally, for eight ***Annual Report*** chemicals, information is inadequate to judge the magnitude of human exposure.[18]

EPA has interim standards in place for 7 of the 120 chemicals detected in drinking water. Fifteen chemicals are included in the current RMCL/MCL process. For 18 chemicals, health advisories have been prepared, although the health advisory represents the only EPA action on 5 of those chemicals in drinking water. These actions cover 21 chemicals altogether; all but one of these were estimated to present significant human exposure. [19]

There has been no EPA action on drinking water exposures for the remaining 99 chemicals. Of these, 11 chemicals (beryllium, 2,4,6-trichlorophenol, and 9 of the 10 polycyclic aromatic hydrocarbons) were estimated to present significant known or potential human exposures.

OTA's jurisdiction for actions under the Safe Drinking Water Act consists of the 21 chemicals covered by interim standards or the current RMCL/MCL process and 11 additional chemicals with known or potential exposures in drinking water. Of these 32 ***Annual Report*** chemicals, 7 have interim standards, 15 are being considered in the RMCL/MCL process, and 11 have not been addressed by regulatory action.

Positive NCI/NTP Chemicals

Twelve positive NCI/NTP chemicals are addressed by either the interim standards under the act or the current RMCL/MCL standard-setting process. The two interim standards covered toxaphene (in 1975) and chloroform (in 1979). Eleven positive NCI/NTP chemicals are addressed by the current RMCL/MCL process: for three, final RMCLs and final MCLs have been issued; for one, a proposed MCL is pending; and for seven, proposed RMCLs are still pending. (Regulatory standards and proposals cover a total of 12 chemicals because chloroform is not now being addressed by the RMCL/MCL process.)

Fourteen of the positive NCI/NTP chemicals are found in drinking water and have been subjects of health advisories. Four of these chemicals have standards or proposed RMCLs. Thus 10 positive NCI/NTP chemicals found in drinking water are addressed by health advisories, but not by the standards-setting process,

[18] These chemicals were not included in the OTA-defined jurisdiction.

[19] The exception is 2,3, 7,8-tetrachlorodibenzo-p-dioxin.

EPA staff indicated to OTA that another 24 positive NCI/NTP chemicals are found in drinking water, but in their judgment, 22 are not significant or data are not available on them. The two with a significant known or potential presence in drinking water that are also not addressed by the standards-setting process or health advisories are 2,4,6-trichlorophenol (three positives) and di-(2-ethylhexyl) -adipate (two positives).

The OTA-defined jurisdiction in this case includes only those chemicals EPA has acted on or that present significant potential drinking water hazards. Thus, the jurisdiction with regard to positive NCI/NTP chemicals consists of 14 chemicals. Of these, 2 are addressed by interim standards, 11 by current regulatory activity, and 2 by no action .20

EPA Actions Under the Federal Insecticide, Fungicide, and Rodenticide Act

Annual Report Chemicals

Twenty-four ***Annual Report*** chemicals are or were registered as active pesticide ingredients under FIFRA.[21] Thirteen of these are listed as "pesticides" in the ***Annual Report;*** the remaining 11 substances are listed in other categories but have or had pesticide uses. The 24 chemicals include 6 that were voluntarily canceled for some or all uses (acrylonitrile, Aramite, arsenic, benzene, Kepone, and Safrole).[22] Another eight were subject to complete or partial cancellation by EPA (Amitrole, carbon tetrachloride, DDT, DBCP, EDB, Mirex, Toxaphene, and vinyl chloride), and five were subject to special review but were not canceled or suspended (cadmium, chloroform, ethylene oxide, and Lindane). For Nitrofen and sulfallates, EPA has only set food tolerances. Food tolerances are also reported for six other ***Annual Report*** pesticides. A registration standard has been issued for formaldehyde.

No actions are reported for three chemicals used as active pesticide ingredients: 2,4,6-trichlorophenol, hexachlorobenzene, and l,2-dichloroethane. The ***Annual Report,*** however, suggests that 2,4,6-trichlorophenol is no longer being produced because of the expense of removing dioxin contamination.

Positive NCI/NTP Chemicals

Twenty-seven positive NCI/NTP chemicals are or were used as active ingredients in pesticides: seven with four positive results, four with three positives, six with two positives, and five with one positive. NTP has also tested DDE, which is associated with DDT, and which yielded two positive results, for a total of 28 positive NCI/NTP chemicals.[23]

For about half of these chemicals some uses have been suspended, canceled, or voluntarily canceled, although nearly all of these chemicals remain on the market for at least some uses. EPA has canceled or suspended nine chemicals: DBCP (four positive results), EDB (four positive results), Chlordane (two positives), Heptachlor (two positives), chlorobenzilate (two positives), p,p'-DDE (a contaminant and metabolize of DDT) (two positives), propylene dichloride (two positives), Toxaphene (two positives), and Aldrin (one positive), Two of these (Chlordane and Heptachlor) are closely related chemically; EPA acted on them simultaneously. In addition, four chemicals ***were*** voluntarily canceled as active ingredients: benzene (four positive results), Chlordecone (Kepone) (four positives), Nitrofen (three positives), and Monuron (one positive). Of these 13 chemicals affected by regulatory and voluntary cancellations and suspensions, a number remain on the market for some uses. For example, Chlordane was canceled for food uses, but is still used for termite control.

The 15 remaining positive NCI/NTP chemicals are still on the market with their uses unchanged by suspension, cancellation, or voluntary cancellation. For one of these chemicals, Tetrachlorvinphos (three positives), EPA judged that the weight

Zoo$_{ne}$ chemical is addressed by both interim standards and current regulatory activity.

ZIT$_{we}$I$_{ve}$ A~ual ***Report*** chemicals are used as inert ingredients in pesticide formulations. In 1987, EPA announced a policy covering some of these inert ingredients (see ch. 3).

[22]Non-Lindane isomers of hexachlorocyclohexane were also voluntarily canceled, although Lindane itself is still marketed.

[23]There are also 13 positive NCI/NTP chemicals that are used as inert ingredients, including 2 that are or were used as active ingredients.

of the evidence does not support regulation. Several of the other chemicals have been subjects of special reviews or registration standards and two have been proposed for cancellation (Captan and Dicofol). To some extent, EPA has issued requirements for labeling and use of protective equipment with these chemicals, but OTA did not evaluate these measures.

EPA Actions Under the Toxic Substances Control Act

Annual Report Chemicals

Under TSCA, 32 of the 145 ***Annual Report*** chemicals have received some attention. Most of this attention has consisted of developing information, including reporting requirements and Chemical Hazard Information Profiles (CHIPS). Under section 8, EPA can issue regulations requiring manufacturers to provide information on production, uses, exposures, environmental and health effects, and disposal of chemicals (sec. 8(a)) and requiring manufacturers to submit unpublished health and safety studies (sec. 8(d)) .24 CHIPS are medium-sized reviews (e.g., 20 to 70 pages) of physical properties, production and exposure information, health effects, environmental effects, and other existing standards and regulations for particular chemicals.

Eighteen ***Annual Report*** chemicals are subject to section 8(a) or 8(d) reporting rules. EPA has prepared CHIPS for 10 other chemicals: benzotrichloride, hydrazobenzene, Michler's base, 5-nitro-o-anisidine, o-toluidine, 1,4-dioxane, 2-nitropropane, thiourea, thorium dioxide, and toluene diisocyanate (TDI). The first five of these chemicals are used in manufacturing dyes, while 1,4-dioxane and 2-nitropropane are used as solvents. The remaining three chemicals are classed as miscellaneous chemicals and industrial chemicals.

EPA has issued final regulations banning production under section 6 for one ***Annual Report*** carcinogen—PCBS. As described in chapter 3, Congress specified this action under TSCA. A section 6 proposal on asbestos is pending. This proposed regulation would limit and eventually eliminate the use of asbestos.[25] For two other ***Annual Report*** chemicals–formaldehyde and MDA–EPA has initiated an expedited review under section 4(f) and then referred regulatory consideration to OSHA. EPA has issued significant new use rules for two ***Annual Report*** chemicals: hexamethylphosphoramide and urethane.

As defined by OTA, the TSCA jurisdiction consists of all chemicals in the ***Annual Report,*** although regulatory action under TSCA would differ depending on whether or not a chemical is produced. According to the information available to OTA, domestic production of 47 ***Annual Report*** chemicals exceeds 1 million pounds. Another 66 chemicals are produced, but in quantities less than 1 million pounds, 13 chemicals are currently not produced, and the production status of 19 chemicals is unknown.

Narrowing attention to just those ***Annual Report*** chemicals produced in quantities greater than 1 million pounds yields 6 chemicals with EPA-prepared CHIPS and 11 chemicals subject to section 8(a) or 8(d) reporting rules. The section 4(f) designations, significant new use rules, and the section *6* proposal on asbestos (mentioned above) all affect chemicals drawn from this high-production group. After eliminating multiple actions on the same chemical, there are 20 high-production chemicals addressed by some action and 27 high-production chemicals on which no action has been taken.

Under TSCA, for chemicals currently not produced EPA could require manufacturers to report significant new uses or provide production or exposure information prior to restarting production. Of the 145 carcinogens in the ***Annual Report, 13*** chemicals are not currently produced. Because of

[24] Sec. 8(e) of TSCA requires manufacturers to report to EPA information on chemicals that present a "substantial ***risk of*** injury to health or the environment." While processing these reports has been an important TSCA activity, it is not directly regulatory and its purpose is to aid in identifying new hazards. This analysis discusses chemicals already identified as carcinogenic in the ***Annual Report or*** by NCI/NTP tests.

[25] In addition, EPA has issued a regulation concerning certain State and local government employees exposed to asbestos during removal operations, but whose working conditions are not regulated by OSHA or the States. This standard is similar to the asbestos standard issued by OSHA for other workers.

the congressional ban, PCBs are among these chemicals. The remaining 12 chemicals have no TSCA reporting requirements.

Positive NCI/NTP Chemicals

Three NCI/NTP chemicals have been reviewed under section 4(f) of TSCA: MDA, 1,3-butadiene, and methylene chloride. Methylene chloride and MDA had four-positive results in the NCI/NTP tests, while 1,3-butadiene showed two positives. However, 1,3-butadiene had already been shown to be carcinogenic in rats and thus NTP tested in mice only. Including the positive rat data would give this chemical a four-positive result as well.

The NTP test results for these chemicals led directly to TSCA activity. EPA has referred consideration of formaldehyde, 1,3-butadiene, and MDA to OSHA under section 9 of TSCA.

One positive NCI/NTP chemical, asbestos, has been proposed for regulation under section 6. Although the NTP tests found some evidence for carcinogenicity in male rats (one positive), the primary basis for all asbestos regulation is the human epidemiologic data. [26] EPA has also issued a significant new use rule for pentachloroethane (two positives).

Most of TSCA activity on existing chemicals tested by NCI/NTP has involved reporting requirements under section 8 of TSCA and the preparation of TSCA evaluation documents. The development of this information should be helpful to any future regulatory activity.

OTA considers all the positive NCI/NTP chemicals to be in the TSCA jurisdiction. Section 8(a) or 8(d) rules have been issued or CHIPS prepared for 53 of the 144 positive NCI/NTP chemicals .27 Twenty-two of the 61 chemicals with four-positive and three-positive results have been the subjects of section 8(a) or 8(d) reporting rules or CHIPs.[28]

[26] Rules concerning manufacture and disposal of PCBS have also been issued under sec. 6. However, this action occurred because of congressional directive. The NCI/NTP test results for Arochlor 1254 (a PCB) were negative.

[27] These include 22 sec. 8(a) or 8(d) rules and 37 CHIPS. The total is 53 because not all of the chemicals are covered by both.

[28] These include 11 chemicals subjected to 8(a) or 8(d) rules and 17 chemicals with CHIPS.

EPA Actions Under the Resource Conservation and Recovery Act

Annual Report Chemicals

Compared to the regulation responses of other agencies to the Annual Report list, those of RCRA and CERCLA are the most comprehensive, although their corresponding programs do not address a number of ***Annual Report*** chemicals.

Two lists of chemicals are important for the RCRA program: a list of hazardous wastes (which lists commercial chemicals and waste streams) and a list of hazardous constituents of listed wastes (Appendix VIII of RCRA). The RCRA hazardous waste list currently includes 89 ***Annual Report*** carcinogens, while Appendix VIII includes 18. Because 10 chemicals are on both lists, the number of chemicals covered by the two lists together is 97. An additional 20 ***Annual Report*** chemicals, not included in either list, are proposed for inclusion in the list of hazardous wastes and 1 (iron dextran complex) is proposed for removal.

The RCRA lists should be prospective, allowing for the possibility that toxic chemicals currently not produced might be produced in the future and need to be disposed of safely. Therefore, as defined by OTA, the jurisdiction for RCRA consists of all chemicals in the ***Annual Report,*** whether ***or*** not they are currently produced.

The two RCRA lists currently include 97 of the 145 chemicals in the ***Annual Report;*** 48 ***Annual Report*** chemicals are not included. Some of the 48 ***Annual Report*** chemicals not listed under RCRA are not currently produced commercially —4 according to the SRI data reported in HSDB. Another six ***Annual Report*** chemicals were not found in HSDB or did not have production data reported and some of them may also not be produced. Thus, 38 ***Annual Report*** chemicals are produced but not included in the RCRA lists. Nine of these are produced in quantities greater than 1 million pounds.

Positive NCI/NTP Chemicals

Of the 144 positive NCI/NTP chemicals, 41 appear in either one of the RCRA lists (or both), while 103 positive NCI/NTP chemicals do not.

Limiting attention to chemicals testing positive in three or four experiments, or 61 chemicals, 39 chemicals *(64* percent) have not been listed. Nineteen of the 103 positive NCI/NTP chemicals not included in the RCRA lists are not currently produced. Twenty-six chemicals were not found in HSDB or had no reported production data, and some of these may also not be produced. Fifty-eight of the 103 positive NCI/NTP chemicals are produced but not included in the RCRA lists. Sixteen of these are produced in quantities greater than 1 million pounds.

EPA Actions Under the Comprehensive Environmental Response, Compensation, and Liability Act

Annual Report Chemicals

The CERCLA list includes 95 ***Annual Report*** carcinogens, most of which RCRA also lists as hazardous wastes. Chemicals that were only included in RCRA Appendix VIII have not been incorporated in the CERCLA list, although EPA has issued an Advance Notice of Proposed Rule Making requesting comments about including them.

Activities under CERCLA may need to assess the hazards of chemicals no longer produced, but found in waste dumps from past production. OTA has not developed any information on which ***Annual Report*** chemicals have been found in dump sites or have been released into the environment.[29] The OTA-defined jurisdiction for CERCLA consists of all the chemicals in the ***Annual Report,*** whether or not they are currently produced.

Fifty of the 145 ***Annual Report*** chemicals are not included in the CERCLA list. Examining the chemicals currently produced in quantities greater than 1 million pounds yields nine not covered under CERCLA.

[29] EPA has recently published a list of 100 hazardous substances most commonly found at cleanup sites and which will be the subjects of toxicologic profiles required by sec. 110 of the 1986 Superfund amendments (302).

Positive NCI/NTP Chemicals

Of the 144 positive NCI/NTP chemicals, 47, or about one-third, are included in the CERCLA list. Two-thirds of the positive NCI/NTP chemicals (94) are thus not included. Of the 61 chemicals with three or four positive experiments, 22 are listed and 39 are not.

EPA recently proposed to adjust, based on evidence of carcinogenicity, the reportable quantities (RQs) for chemicals on its CERCLA list. (The EPA method for this is described in ch. 3.) The proposed adjustments do not add chemicals to the list, but change the RQ based on the classification of a chemical as a high hazard, medium hazard, or low hazard with regard to carcinogenicity. The 47 chemicals on the CERCLA list should thus be affected by the proposed adjustments. Only 32, however, are actually included in the list of chemicals evaluated for these adjustments. The 15 positive test result chemicals on the CERCLA list, but not evaluated for carcinogenicity, include several major industrial chemicals: methylene chloride, 1,2-propylene oxide, ethyl acrylate; 1,3-dichloropropene (Telone II), and TDI.

Assessments by EPA's Carcinogen Assessment Group

Annual Report Chemicals

CAG has prepared health assessments for 78 ***Annual Report*** chemicals. While selection of chemicals for CAG assessment depends on the needs of other programs within EPA, 67 of the chemicals and exposures listed in the ***Annual Report*** have not been covered by CAG's health assessments. These chemicals include 14 produced in quantities greater than 1 million pounds.

Positive NCI/NTP Chemicals

In all, CAG has conducted 22 assessments of the 144 positive NCI/NTP chemicals: 6 chemicals with four-positives, 3 with three-positives, 11 with two-positives, and 2 with one-positive. Grouping chemicals with four-positive and three-positive results together, the NCI/NTP test results cover

61 chemicals. CAG has prepared full assessments for nine of these, or about 15 percent.[30]

No Apparent Activity

Positive NCI/NTP Chemicals

Based on information available to OTA, *43* positive NCI/NTP chemicals appear not to have been regulated or evaluated by any agency. These include 13 with four-positive results, 10 with three-positives, 12 with two-positives, and 8 with one-positive result. None of these chemicals is produced in a quantity greater than 1 million pounds. Ten are produced in quantities of less than 1 million pounds, 15 are not commercially produced, and the production status of 18 is unknown.

[30] As discussed, CAG has also conducted analyses of available information for adjusting the CERCLA reportable quantities based on carcinogenicity.

AGENCY COMMENTS

In comments on a draft of this background paper, officials of Federal regulatory agencies emphasized their belief that they have acted appropriately in regulating the chemicals tested by NCI/NTP and the Annual ***Report.*** They pointed out that their statutes require that they assess risks and benefits of using chemicals, as well as the technical feasibility and costs of regulatory action. Agency responses to information on carcinogenicity sometimes involve requiring additional information enabling the agencies to make better decisions. In some cases, the agencies have decided that regulation is not necessary because a substance is no longer produced, does not present exposures, or the benefits of continued use exceed the risks. They stated that identification of a chemical as carcinogenic does not imply a need for regulation. EPA commented:

> Our decision rules are just not so simple. Also, as the report basically tallies regulations and cannot readily assess decisions not to regulate, a biased picture emerges of the extent to which the Federal government has acted on carcinogens (104).

FDA commented:

> We believe that FDA has acted responsibly and appropriately with regard to chemicals identified as carcinogens. Each purported carcinogen under the Agency's purview has been evaluated, and a determination of the appropriate course of action has been made, There is no backlog awaiting Agency review. Since many of the substances required no regulatory action, the Agency has made no formal public statements regarding those decisions ***(24).***

SUMMARY

The ***Annual Report on Carcinogens*** is a useful compendium of information on carcinogenic chemicals, including its coverage of the uses of these chemicals and related regulatory actions. The NCI/NTP test results are useful for risk assessments of particular chemicals. Together, the NCI/NTP tests provide information useful for further development of risk assessment methods and exploration of topics in hazard identification. Such information has a research value in addition to its potential regulatory uses.

Table 5-3 summarizes the number of ***Annual Report*** chemicals and positive NCI/NTP chemicals acted on by each agency and program as well as the corresponding number of chemicals determined to be in the OTA-defined jurisdiction .31 These tables separate the chemicals discussed in

[31] Two tables in app. B list the chemicals included in this analysis: table B-1 lists the chemicals that appear in the ***Annual Report on Carcinogens;*** table B-2 lists the chemicals tested by NCI/NTP and indicates the corresponding level of evidence.

Table 5-3.—Agency Actions on positive NCI/NTP chemicals and Annual Report Chemicals—Actions and Jurisdiction[a]

	Level of evidence					
	NCI/NTP chemicals					
	At least one positive experiment		Three and four positive experiments		*Annual Report* chemicals	
	Actions	Jurisdiction	Actions	Jurisdiction	Actions	Jurisdiction
No activity	—	43	—	23	—	—
CAG assessment	22	144	9	61	78	145
RCRA listed or App. VIII	41	144	22	61	97	145
CERCLA						
Listed	47	144	22	61	95[b]	145
Proposed RQ adjust.	32	47	15	22		
CWA WQC or standards	14	27	7	10	48	65
SDWA						
Interim std. (1975 and 1979)	2	14	1	7	7	32
Proposed and final RMCL	11	14	5	7	15	32
Total[c]	12		6		21	
CAA listed	2	12	1	8	6	15
TSCA						
Rule 8a or 8d or CHIP	53	144	22	61	28	145
4(f) review/SNUR/Sec. 6	5	144	2	61	6	145
Total[c]	56		24		33	
FIFRA						
Susp. Cane.	9	22	2	11	7	24
Vol. Cane.	4	22	3	11	5	24
Total[c]	13		5		12	
Food and Cosmetics (Ban, SUR, or action level)	17	48	7	19	46	52
FDA						
Animal drugs (revoked/withdrawn)	4	5	1	1	2	6
Human drugs (labeled/withdrawn).	6	12	5	6	26	31
NIOSH recommendation	31	62	13	39	59	112
OSHA						
Noncancer std.	27	53	15	30	35	110
Cancer std.	2	53	1	30	17	110
Total[c]	29		16		52	
CPSC						
Ban/restricted	2	14	1	7	11	23
Voluntary reduction only	57	14	3	7	8	23
Total[c]	8		4		18	

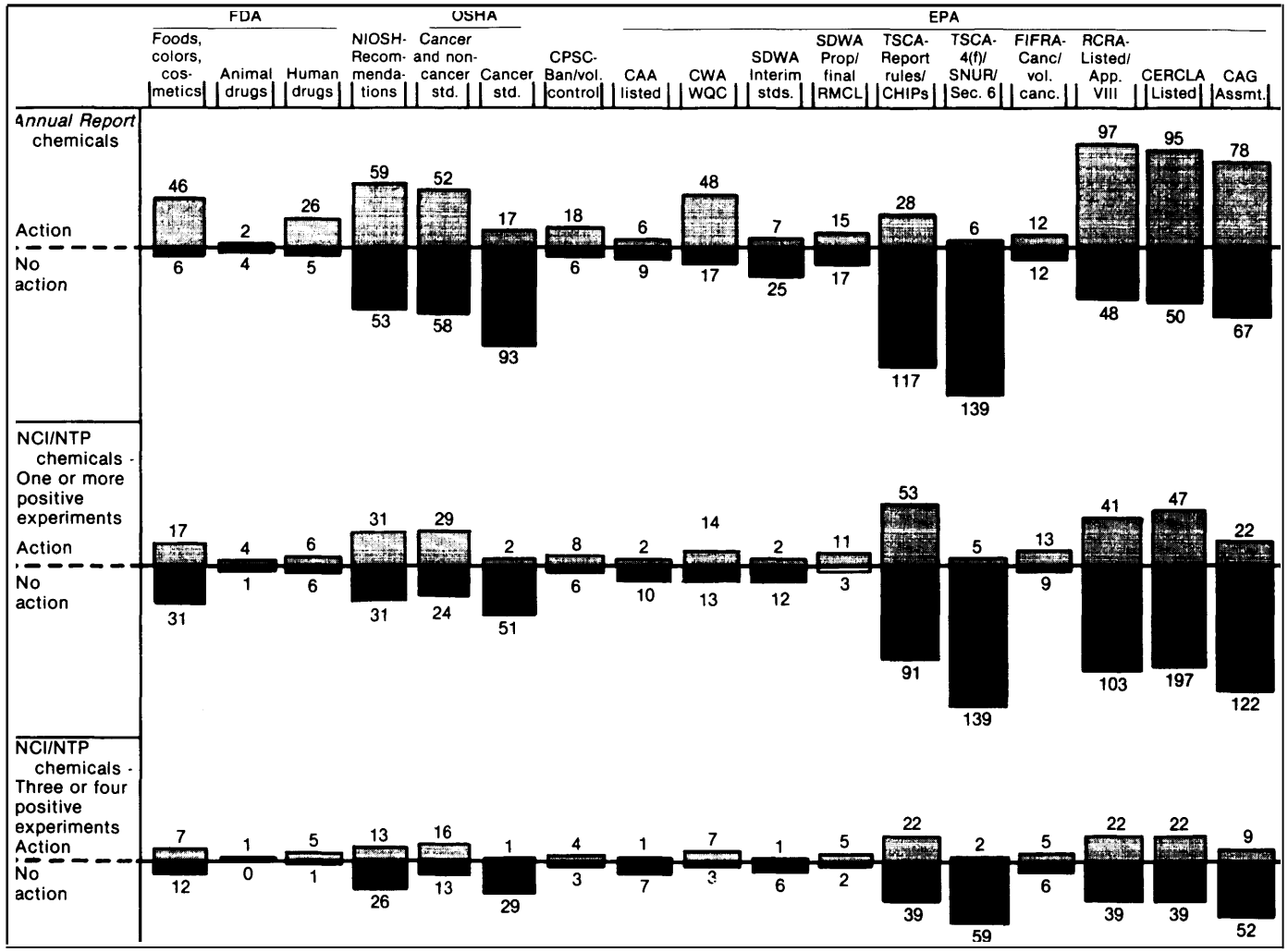
aJurisdiction refers t. the number of chemicals for which the agency is held responsible Wing the results of OTA'S analysis. (See ch. 5).
'Not determined.
[c]Total after eliminating double COunting.

SOURCE: Office of Technology Assessment, 1987

this chapter into three groups: all NCI/NTP chemicals with at least one positive experiment, the NCI\NTP chemicals with three or four positive experiments, and the chemicals included in the ***Annual Report.*** Figure 5-1 summarizes these results by presenting graphically the number of these chemicals that have been acted on and the number not acted on for each agency and program included in the OTA analysis.

In general, while a number of regulatory actions appear to have been based directly on positive NCI/NTP results, there also appear to be substantial gaps in regulatory activity. Considering

Figure 5-1.—Agency Actions on *Annual Report* and Positive NCI/NTP Chemicals[a]



[a]For each agency or program, OTA included only chemicals in the OTA-defined jurisdiction for that agency or program. Agency decisions that regulation is not necessary or appropriate were included in the no action groups. Because of overlap between the three lists of chemicals, it is not appropriate to add them together. All actions through July 1987 are represented in this figure.

Key to acronyms: CAA—Clean Air Act; CAG—Carcinogen Assessment Group; CERCLA—Comprehensive Environmental Response, Compensation, and Liability Act; CHIPs—Chemical Hazard Information Profiles; CPSC—Consumer Product Safety Commission; EPA—Environmental Protection Agency; FDA—Food and Drug Administration; FIFRA—Federal Insecticide, Fungicide, and Rodenticide Act; NCI—National Cancer Institute; NIOSH—National Institute for Occupational Safety and Health; NTP—National Toxicology Program; OSHA—Occupational Safety and Health Administration; RCRA—Resource Conservation and Recovery Act; RMCL—recommended maximum contaminant level; SDWA—Safe Drinking Water Act; SNUR—Significant New Use Rule; TSCA—Toxic Substance Control Act; WQC—Water Quality Criteria.

SOURCE: Office of Technology Assessment, 1987.

each agency or program individually reveals that no agency has regulated more than a third of the positive test results. More typically, an agency will have acted out of concern for carcinogenicity on 5 to 30 of the 144 chemicals that tested positive in NCI/NTP bioassays.

As described in this chapter, OTA has attempted to focus on the chemicals of potential regulatory interest for each agency or program. However, as shown in table 5-3 and figure 5-1 and as discussed in this chapter, even when attention is limited to chemicals in the jurisdiction of the different agencies and programs, there appear to be omissions in regulatory coverage. The importance of these apparent regulatory gaps depends on factors not analyzed by **OTA,** including the extent and magnitude of exposures, the potency of the chemicals, as well as other exposures and risk factors. In some cases, voluntary industry actions may have reduced or eliminated risks in the absence of government regulation. OTA has not determined the extent of these voluntary actions.