EPA 550/9-77-253

PRODUCT NOISE LABELING STANDARDS

DRAFT

BACKGROUND DOCUMENT FOR PRODUCT NOISE LABELING GENERAL PROVISIONS

APRIL 1977

U.S. Environmental Protection Agency
Office of Noise Abatement and Control
Washington, D.C. 20460

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Prepared By

THE U.S. ENVIRONMENTAL PROTECTION AGENCY
Office of Noise Abatement and Control

FOREWORD

This Background Document has been prepared by the Environmental Protection Agency in support of the Proposed Product Noise Labeling Standards - General Provisions. The proposed regulation will be promulgated under the authority of sections 8, 10, 11, and 13 of the Noise Control Act of 1972.

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INTRODUCTION

This report represents the findings of study efforts instituted by the U.S. Environmental Protection Agency for the purpose of developing general background information necessary for the implementation of Section 8 of the Noise Control Act of 1972 dealing with product noise labeling. These findings were utilized in the development of the Agency's Proposed Product Noise Labeling Standards - General Provisions.

The report is composed of four sections. Section 1 deals with a review of other Federal labeling efforts. Section 2 contains a discussion of some of the major issues involved in formulating a general approach to product noise labeling under Section 8 of the Noise Control Act. Section 3 presents an approach to the design graphics associated with a noise labeling program, demonstrating the various considerations involved in the formulation of graphical requirements. The discussions of Section 2 and 3 draw upon the reviews of other labeling efforts presented in Section 1, the expertise of public relations consultants, as well as the study of published reports concerning labeling programs (primarily Federal), and of texts and articles on visual communication through symbols and legends. All source materials are noted in the bibliography covering Sections 2 and 3. Section 4 deals with potential technical problems associated with the development of specific noise rating schemes; the example used here addresses common household appliances.

BACKGROUND

Section 8 of the Noise Control Act states that the Administrator of the Environmental Protection Agency shall promulgate regulations designating and labeling products or classes of products which emit noise capable of adversely affecting the public health or welfare, or which are sold wholly or in part on the basis of their effectiveness in reducing noise.

Section 8 further stipulates that the labeling regulations developed by the EPA specify as a minimum 1) the manner and location in which notice is to be provided 2) the form of the notice, and 3) the methods and units of measurement to be used.

It is clear from Section 8 that Congress' intention in requiring the promulgation of noise labeling regulations was to provide notice to prospective purchasers or users of either a product's noise level or its effectiveness in reducing noise.

Agency action toward implementing Section 8 of the Act has already taken place through the issuance of an Advance Notice of Proposed Rulemaking concerning the designation and labeling of hearing protectors which appeared in the Federal Register on December 5, 1974, 39 FR 42380. Further regulatory action specifying the detailed labeling requirements for hearing protectors will be conducted through a separate rulemaking action proposing such requirements as a separate subpart to be added to the general provisions being proposed by the Agency.

Both the development and the implementation of a Federal noise labeling program under Section 8 of the Noise Control Act are to a large extent influenced by the overall purposes and goals to which such a program is committed. In formulating the objectives of its noise labeling program the EPA has considered the statutory language of Section 8 as well as the overall need for and the positive and negative aspects attendant to Federal regulatory efforts in controlling environmental noise. As such, the Agency will be patterning the further development and implementation of its noise labeling program consistent with the following objectives:

1. To provide accurate and understandable information to product purchasers and users regarding the acoustic properties of designated products so that meaningful comparisons can be made concerning the acoustic properties of the products as part of purchase or use decisions.

2. To accomplish the providing of accurate and understandable information to consumers with minimal Federal involvement. Minimal Federal involvement is to be achieved by ensuring that the Federally-imposed labeling requirements are carefully analyzed and structured so as to reduce as much as possible the administrative, economic and technical impacts of the Federal program.

3. To promote public awareness and understanding of environmental noise and the associated terms and concepts.

4. To promote effective voluntary noise reduction and noise labeling efforts on the part of product manufacturers and suppliers.

The Agency's policy in the development and implementation of a noise labeling regulatory program is to initiate such a program in as simplified a form as is possible. The program and its effects will then be continually evaluated

as to the need for revisions to the various elements of the regulatory approach being taken. For example, such revisions may be in response to the need for the more detailed specification of labeling requirements such as those concerning the information to be provided or the form in which the information is presented.

It is intended that complete Agency labeling action with respect to any product will consist of the requirements contained in the proposed general provisions along with those contained in the product specific subparts to be added on a product by product basis. The Agency will provide notice that it is planning to develop labeling requirements for particular products or product classes by the publication of an Advance Notice of Proposed Rulemaking in the Federal Register. A public comment period will be provided concerning the notification. The designation of products under section 8(a) of the Act will be accomplished within the Notice of Proposed Rulemaking for those products.

Where specific aspects of the general provisions are found by the Agency to be inapplicable to a certain product or product type, or where the need for additional or modified provisions is apparent, such exceptions, additions or modifications will be incorporated within the product specific provisions.

The general provisions being proposed can and hopefully will, however, provide guidance to the general public as well as all affected parties as to the general nature and intent of the Agency's proposed labeling regulatory program. In addition, it is hoped that the provisions will serve as further guidance to product manufacturers and supplies in their understanding of and in preparing for possible Federal noise labeling requirements, and as to the possible initiation of compatible voluntary industry noise labeling programs.

SECTION 1

REVIEW OF LABELING LAWS

As part of a general study on EPA noise labeling, an extensive review of Federal, industry, and private labeling efforts was undertaken. The review was conducted so that EPA might gain insight into its noise labeling program from existing labeling programs. Of particular interest were government agency consumer information labeling programs. Lists of the agencies and examples of general categories and specific products reviewed are given in Tables 1 and 2. This section contains summaries of 25 significant government labeling efforts. The summaries are of two types: summaries of labeling regulations affecting specific products and summaries of labeling requirements set forth in the mandating Acts.

The reviews are not to be construed as complete, authoritative descriptions of the government labeling programs, but rather as interpretative summaries that highlight the labeling issues relevant to EPA.

Table 1-1

Federal Agencies Involved in Labeling

Atomic Energy Commission
Consumer Product Safety Commission
Department of Agriculture
Department of Commerce
Department of Defense
Department of Justice
Environmental Protection Agency
Federal Energy Commission
Federal Trade Commission
Food and Drug Administration (HEW)
National Highway Traffic Safety Administration (DOT)
Occupational Safety and Health Administration (DOL)

Table 1-2

Examples of Specific Products and General Categories
Subject to Labeling Laws

Tires
Electrically operated toys
Charcoal briquettes
Air conditioners
Lawn darts
Toy caps
Bicycles
Car seats for children
Power amplifiers
Refrigerators, freezers
Textile wearing apparel and yard goods
Full-size cribs
Hazardous substances
Insecticides, fungicides and rodenticides
Gasoline
Cigarettes
Drugs
Food
Light bulbs
Motor vehicles
Electric appliances
Upholstered products
Agricultural seed
Occupational safety equipment

1. CIGARETTES

A.	PRODUCT:	Cigarettes: Labeling required under "Public Health Cigarette Smoking Act" (P.L. 89-92)
B.	AGENCY:	Department of Justice
C.	PURPOSE:	Information with respect to any relationship between smoking and health
D.	GRADE/RATING:	Not graded or rated under the above Public Laws
E.	TECHNICAL BASIS/ ORGANIZATION:	No technical basis per se since there is no grading, but there is a technical basis behind the Congressional decision to require a warning on all cigarette packages.
F.	LABEL CONTENT:	"Warning: The Surgeon General has Determined that Cigarette Smoking is Dangerous to Your Health"
G.	PHYSICAL CHARACTERISTICS:	Specified as follows: Conspicuous and legible type in contrast by typography, layout or color with other printed matter on the package.
H.	LOCATION:	Conspicuously located on every package.
I.	COMMENTS:	This is informational labeling specified by Congress and administered by the Department of Justice

2. PRODUCTS COVERED BY: "FAIR PACKAGING AND LABELING ACT"

A.	PRODUCT:	All products for which labeling is required under the "Fair Packaging and Labeling Act: (15 USC 1451 *et. seq.*)
B.	AGENCY:	Federal Trade Commission (16 CFR 500-503)
C.	PURPOSE:	Truthful packaging and labeling of products
D.	GRADES/RATINGS	Not applicable
E.	TECHNICAL BASIS/ CATEGORIZATION:	
F.	LABEL CONTENT:	1. Statement of identity: "name" 2. Name and place of business of the manufacturer, packer or distributor 3. Net quantity of contents 4. If the label bears a representation as to the number of servings, uses, or application of such commodity, the label shall bear in immediate conjunction therewith, a statement of the net quantity of each such serving, use or application.
G.	PHYSICAL CHARACTERISTICS:	Specified as follows: 1. Type size must be easily read 2. Type must be parallel to the base of the package
H.	LOCATION:	Specified as follows: 1. The Statement of identity and the net quantity must appear on the "Principal Display Panel". 2. The net quantity declaration shall be placed in the bottom 30 percent of the area of the label panel. 3. The name and place of business of manufacturer ... shall be conspicuously located on the package.

3. FOOD COVERED BY "FEDERAL FOOD, DRUG AND COMESTIC ACT"

A.	PRODUCT:	Food: Labeling required under the "Federal Food, Drug and Cosmetic Act" (21 USC 301 *et. seq.*)
B.	AGENCY:	Department of Health, Education and Welfare; Food and Drug Administration
C.	PURPOSE:	Standards of identity and definition, quality, and fill of container for the purpose of promoting honesty and fair dealing in the interest of consumers.
D.	GRADES/RATINGS:	Not graded per se. The Act prohibits the introduction of adulterated or misbranded food into interstate commerce. The Act defines misbranded and adulterated food. In general terms, adulterated food is deemed to be any food which "contains any poisonous or deleterious substance which may render it injurious" to health or if it "is otherwise unfit for food."
E.	TECHNICAL BASIS/ CATEGORIZATION:	
F.	LABEL CONTENT:	Food: The following information must appear on the label: 1. The name and place of business of the manufacturer, packer or distributor 2. An accurate statement of quantity of contents in terms of weight, measure or numerical count. 3. If the product is an imitation of another food, the word imitation (in type of uniform size and prominence) immediately preceding the name of the food imitated. 4. If the product purports to be or is represented for special dietary uses, information concerning its vitamin, mineral and other dietary properties. 5. If the product bears or contains any artifical flavoring, artifical coloring or chemical preservative, a statement of that fact.

6. If the product purports to be or is represented as food for which a definition and standard of identity has been prescribed by regulations, the name of the food as specified in the definition and standards, and insofar as may be required by such regulations, the common names of optional ingredients.
7. If the food purports to be or is represented as a food for which a standard of quality has been prescribed by regulations and its quality falls below such standard, a statement that it falls below such standard (in a manner and form as such regulations specify).
8. If the food purports to be or is represented as a food for which a standard or standards of fill of container have been prescribed by regulations and it falls below the standard of fill of container applicable thereto, a statement that it falls below such standard (in a manner and form as such regulations specify).
9. If the product is not subject to the requirements of item 6, the common or usual name of the food, if any there be, and in case it is fabricated from two or more ingredients, the common or usual name of each such ingredient.
10. If it is a raw agricultural commodity which is the product of the soil, bearing or containing a pesticide chemical applied after harvest, the shipping container of such commodity must declare the presence of such chemical in or on such commodity and the common or usual name and the function of such chemical.

11. Labeling must be in conformance with an applicable regulation issued pursuant to Section 3 or 4 of the Poison Prevention Packaging Act of 1970.

G. PHYSICAL CHARACTERISTICS: Specified as follows:

1. All required information must be placed with such conspicuousness (as compared with other words, statements, designs in the labeling) and in such terms as to render it likely to be read and understood by the ordinary individual under customary conditions of purchase and use.

H. LOCATION: Specified:

1. All required information must be prominently located where it is likely to be read under customary conditions of purchase and use.

4. PRODUCTS COVERED BY CONSUMER PRODUCT SAFETY ACT

A.	PRODUCT:	All products for which labeling is required under the "Consumer Product Safety Act" (15 USC 2051 *et. seq.*)
B.	AGENCY:	Consumer Product Safety Commission
C.	PURPOSE:	To protect the public against unreasonable risks of injury associated with consumer products; to assist consumers in evaluating the comparative safety of consumer products; to develop uniform safety standards for consumer products.
D.	GRADES/RATINGS:	The Commission determines if a consumer product presents an unreasonable risk of injury to the public. If the product does present an unreasonable risk, the Commission then determines whether or not a safety standard will eliminate the unreasonable risk. If no feasible product safety standard would adequately protect the public from the unreasonable risk of injury associated with the product, the Commission may propose and promulgate a rule declaring such product a banned hazardous product. Requirements of CPS standards (other than requirements relating to labeling, warnings or instructions) shall whenever feasible, be expressed in terms of performance requirements.
E.	TECHNICAL BASIS/ CATEGORIZATION:	
F.	LABEL CONTENT:	For any product which is subject to a consumer product safety standard: 1. Date and place of manufacture 2. A suitable identification of the manufacturer or the private labeler and the code mark of the manufacturer in the case of a private labeler. 3. A certification that the product meets all applicable consumer product safety standards and a specification of the standards which are applicable.

G.	PHYSICAL CHARACTERISTICS:	Specified as follows: 1. Such labels, where practicable, may be required by the Commission to be permanently marked on or affixed to any such consumer product.
H.	LOCATION:	Specified as follows: 1. The certificate of conformity shall accompany the product or shall otherwise be furnished to any distributor or retailer to whom the product is delivered.

5. PRODUCTS COVERED BY FEDERAL "HAZARDOUS SUBSTANCES ACT"

A.	PRODUCT:	All products for which labeling is required under the "Federal Hazardous Substances Act" (15 USC 1261 *et. seq.*)
B.	AGENCY:	Consumer Product Safety Commission
C.	PURPOSE:	Consumer protection
D.	GRADES/RATING:	Not graded. A hazardous substance "is any substance or mixture of substances (as determined by the Commission) which is toxic, corrosive, an irritant, a strong sensitizer, flammable or combustible, or generates pressure through decomposition, heat or other means, if such substance or mixture of substances may cause substantial personal injury or substantial illness during or as a proximate result of any customary or reasonable foreseeable handling or use, including reasonably foreseeable ingestion by children. The tests to determine if a product is a hazardous substance are set forth in the regulations".
E.	TECHNICAL BASIS/ CATEGORIZATION:	
F.	LABEL CONTENT:	1. Name and place of business of the manufacturer, packer, distributor or seller; 2. Common or usual name or the chemical name (if there be no common or usual name) of the hazardous substance(s); 3. Signal word "DANGER" on substances which are extremely flammable, corrosive, or highly toxic; the signal word "WARNING" or "CAUTION" on all other hazardous substances; 4. An affirmative statement of the principal hazard or hazards; 5. Precautionary measures describing the action to be followed or avoided; 6. Instructions, when necessary or appropriate, for first aid treatment;

7. The word "POISON" for any hazardous substance which is defined as "highly toxic";
8. Instructions for handling and storage of packages which require special care in handling or storage;
9. The statement "Keep out of the reach of children", or its practical equivalent, or, if the article is intended for use by children and is not a banned hazardous substance, adequate directions for the protection of children from the hazard.
10. Specific product labeling statements as deemed necessary by the Commission as specified in Section 4 of the Poison Prevention Packaging Act;
11. On the container of household substances which do not meet the standards set under Section 3 of the Poison Prevention Packaging Act, the following statement: "This package for households without young children".

G. PHYSICAL CHARACTERISTICS: Specified as follows:
1. Written in the English language
2. Conspicuous and legible type in contrast by typography, layout, or color with other printed matter on the label.

H. LOCATION: Location of label not specified.

6. INSECTICIDES, FUNGICIDES AND RODENTICIDES

A.	PRODUCT:	Labeling of pesticides required under the "Insecticides, Fungicides and Rodenticides Act" and related acts, and EPA regulations at 40 CFR 162
B.	AGENCY:	Environmental Protection Agency
C.	PURPOSE:	Protection of public health through identification of hazards
D.	GRADE/RATING:	Use classification; other information required
E.	TECHNICAL BASIS/ CATEGORIZATION:	The Act states: "unreasonable adverse effects on the environment" i.e., unreasonable risk to man or the environment, taking into account the economic, social and environmental costs and benefits of the use of any pesticide (as determined by the Administrator of the EPA)
F.	LABEL CONTENT:	1. Registration number of manufacturing plant; 2. Directions for use necessary for effecting the purpose for which the product is intended and adequate to protect health and the environment; 3. The statement "Keep Out of reach of Children"; 4. A signal word such as "Danger", "Warning" or "Caution"; 5. Other warning or cautionary statements as necessary to protect the public; 6. Ingredient statement; name, percentage designation; 7. Use classification: general, restricted; 8. Name and address of the manufacturer, packer, formulator, registrant, or person for whom the product is produced;

9. Name, brand or trademark;
10. Net weight or measure of the content;
11. For pesticides containing any substance(s) in quantities highly toxic to man:
    a. skull and crossbones
    b. the word "poison" as well as the word "danger"
    c. a statement of practical treatment in case of poisoning by pesticides.

G. PHYSICAL CHARACTERISTICS: Specified as follows:
1. Any word, statement or other information required must be placed on the label conspicuously (as compared to other words, statements, designs, or graphic matter in the labeling).
2. Likely to be readable and understood by the ordinary individual with normal vision, under customary conditions of purchase and use.
3. If the word "Poison" is required, it must be prominent in red on a background of distinctly contrasting color.
4. Specified are a minimum type size for warning statements and signal words.

H. LOCATION:
1. All information required by the Act must be prominently located on the outside container or wrapper of the retail package so as to be clearly readable when presented or displayed under customary conditions of purchase.
2. Specified are:
    a. the location of signal words and the statement "Keep out of Reach of Children";
    b. location of ingredient statement;
    c. location of skull and crossbones and statement of practical treatment for poisons highly toxic to man.

I. COMMENTS: The above summary applies to the labeling requirements as they have been developed as of summer of 1975; later rulemaking was expected but has not been included.

7. LIGHT-DUTY MOTOR VEHICLES

A. PRODUCT: Light-duty Motor Vehicles "Voluntary Fuel Economy Labeling"

B. AGENCY: Environmental Protection Agency (39 FR 36890), Federal Energy Administration

C. PURPOSE: Provide new car fuel economy information at point-of-sale. The notice states that the primary goal of the program is to reduce energy usage in the transportation sector. Intermediate goals are:

1. To increase public awareness of factors which influence fuel economy;
2. To influence consumers to purchase vehicles with good fuel economy;
3. To influence manufacturers to produce vehicles with improved fuel economy.

D. GRADE/RATING: Fuel economy is not graded per se. Fuel economy values are given in miles-per-gallon, and city and highway values are listed separately.

The manufacturer presents, in one of two forms, fuel economy information for the consumer to use in his evaluation of the vehicles; this is somewhat analogous to "energy labeling".

If the "general fuel economy label" is used, it presents the sales-weighted average of fuel economy values (by car line separately for passenger cars and wagons) of all vehicles with the same engine. The manufacturer may also include the range of data used to derive the sales-weighted average.

If the "specific fuel economy label" is used, it presents the EPA-approved fuel economy values for the specific vehicle configuration.

E. TECHNICAL BASIS/ CATEGORIZATION:

1. City fuel economy is derived from the Federal Emission Test Procedure (40 CFR 85); a separate highway test is prescribed;
2. Fuel economy values are reported to the nearest whole mile-per-gallon.

F. LABEL CONTENT:

Consistent with that indicated in the illustrative examples published in the Federal Register (39 FR 36891) specified are:

1. EPA logo
2. FEA logo
3. Statement of authenticity of test results
4. Results of tests, as described in Section D (above) for either the "general" or "specific" labels
5. Reminder that actual fuel economy varies
6. Where to write to receive a copy of "EPA/FEA 1975 Gas Mileage Guide for New Car Buyers".

G. PHYSICAL CHARACTERISTICS:

1. The label must be of a reasonable size and consistent in format with the illustrative examples published in the Federal Register.
2. Manufacturers may choose to differentiate "specific" from "general" labels by shape, color, size or some other readily apparent feature.

H. LOCATION:

Label must be prominently displayed either on the same window as the price sticker or on the passenger side window or other location approved by EPA/FEA.

I. COMMENTS:

A manufacturer may use either "General Labels" or "Specific Labels", on any vehicle configuration in their model line. If a manufacturer elects to participate in the program he obligates himself to place a label on every car in his product line.

The labeling program will also include a public education and information program.

At the present time a study is being conducted to evaluate the effectiveness of the fuel economy labels. The important information from this study is on the effect on consumers of this type of "awareness" labeling.

8. PASSENGER CAR TIRES

A.	PRODUCT:	Passenger Car Tires
B.	AGENCY:	National Highway Traffic Safety Administration (DOT) (49 CFR 575)
C.	PURPOSE:	Consumer information about tire quality
D.	GRADE/RATING:	Treadwear: 2 or 3 digit number Traction: 0, *, ** Temperature resistance: A, B, C
E.	TECHNICAL BASIS/ CATEGORIZATION:	Treadwear: Projected mileage, based on specified test and calculation procedure, stated as percent of 30,000 miles, rounded off to nearest lower 10% value; e.g., for projected treadwear of 47,000 miles, rating is 150. Traction: Based on traction coefficient on two wet skid pads, grade depends on meeting schedule of values established for both skid pad surfaces. Temperature resistance: Tested on a schedule of increasing speeds under load; grade depends on highest speed without failure.
F.	LABEL CONTENT:	1. On sidewall of tire: a. treadwear grade description and treadwear grade; b. all temperature resistance and traction grades, with appropriate grades circled; 2. On tread surface (except original equipment tires on a new vehicle) and for information furnished prospective purchasers of motor vehicles and tires under paragraph 575.6(c), an explanation of performance area, and a history of all possible grades for traction and temperature resistance, along with a heading "DOT Quality Grade".

G.	PHYSICAL CHARACTERISTICS:	1. Sidewall label: permanently molded with character type, depth and size specified 2. Tread label: not easily removable, indelibly stamped.
H.	LOCATION:	1. On tire sidewall between tire's maximum suction width and shoulder; 2. On tread surface (except original equipment on a new tire).

9. NON-PRESCRIPTION DRUGS

A. PRODUCT: Non-prescription drugs

B. AGENCY: Food and Drug Administration (HEW)

C. PURPOSE: Content and quality information

D. GRADE/RATING:)
E. TECHNICAL BASIS/) Standards (minimum requirements) are
CATEGORIZATION:) set by the FDA

F. LABEL CONTENT: Labeling on the "Principal Display Panel":

1. Statement of the identity of the commodity (established name of the drug) and statement of the general pharmacological category(ies) of the principal intended action(s).
2. Net quantity of the contents.

Labeling elsewhere on packaging:

1. Name and place of business of the manufacturer, packer or distributor
   a. Where a drug is not manufactured by the person whose name appears on the label, the name shall be qualified by a phrase that reveals the connection such person has with such drug: such as "Manufactured for _____", Distributed by _____", or any other wording.
2. Statement of Ingredients (as required by Section 502(e) of the Federal Food, Drug and Cosmetic Act) shall appear together.

G. PHYSICAL CHARACTERISTICS: Regulation specified:

1. Boldface type in distinct contrast to other matter on the package;
2. Size of type (relative to other type on package);
3. Location of net weight statement on principal panel.

H. LOCATION:

1. Statement of identity and net quantity must appear on the "Principal Display Panel"
2. All other required information must appear conspicuously on the product's container.

I. COMMENTS:

The most important point to notice is: the requirement that all specified (important) information be prominently and conspicuously located and that same be placed on the "Principal Display Panel".

10. FOOD

A. PRODUCT: Food

B. AGENCY: Food and Drug Administration, HEW

C. PURPOSE: Truthful information on content and quantity of contents

D. GRADE/RATING:
E. TECHNICAL BASIS/CATEGORIZATION: Grades and standards are determined in accordance with U.S. Department of Agriculture regulations. These labeling requirements are in addition to the USDA grades.

F. LABEL CONTENT:

Labeling required on the "Principal Display Panel":

1. Identity of the commodity
   a. name of the commodity
   b. common or usual name of the food
   c. an appropriately descriptive term.
2. For food marketed in various optional forms, the form must be identified.
3. Net quantity of contents in the measure specified for the particular product or type of product (volume, weight, count, etc.).

Labeling required on the "Information Panel":

1. Name and place of business of manufacturer, packer or distributor.
2. If the number of servings appears, a statement of the net quantity of each serving.
3. Ingredients
   a. where the proportion of expensive ingredient(s) present has a bearing on price or consumer acceptance, the label of such food shall bear a quantitative statement of such ingredient(s).

b. imitation or artificial ingredients -- listed as such.

Labeling permitted on the "Information Panel":
1. Nutrition information
2. A statement of cholesterol, fat and fatty acid content if it conforms with specific requirements.

G. PHYSICAL CHARACTERISTICS:

Specified as follows:
1. Type of letters,
2. Size (relative size) of type (minimum sizes established),
3. Type must be in distinct contrast to other matter on the package.

H. LOCATION:

1. Statement of identity and net weight must appear on the "Principal Display Panel".
2. All other required labeling must appear on the "Information Panel".

I. COMMENTS:

The most important point in this labeling requirement is the stipulation that important information is to be located on the "Principal Display Panel" and that all other required labeling is to be located on the prominently located "Information Panel".

11. MANUFACTURED OR PROCESSED DAIRY PRODUCTS

A.	PRODUCT:	Manufactured or Processed Dairy Products
B.	AGENCY:	Department of Agriculture
C.	PURPOSE:	Quality Information
D.	GRADES/RATING:	U.S. Grade B, A, or AA or an equivalent standard of quality for U.S. name grades, if numerical score grades of a product have not been established.
E.	TECHNICAL BASIS/ CATEGORIZATION:	Grades are composite ratings of various factors depending on the product, such as flavor, appearance and body. The standards are set forth in the code.
F.	LABEL CONTENT:	1. USDA 2. Grade 3. U.S. Department of Agriculture inspection statement.
G.	PHYSICAL CHARACTERISTICS:	1. Minimum size for the shield specified 2. Samples of approved shields are given in the code.
H.	LOCATION:	On package, otherwise not specified.
I.	COMMENTS:	It can be required that the package label, carton or wrapper carrying official identification be stamped or perforated with date packed and the certificate number or a code number to indicate lot and date packed.

12. BUTTER

A.	PRODUCT:	Butter
B.	AGENCY:	Department of Agriculture (7 CFR 58 Subpart P)
C.	PURPOSE:	Quality Information
D.	GRADES/RATINGS:	U.S. Grade AA or U.S. Score 93 U.S. Grade A or U.S. Score 92 U.S. Grade B or U.S. Score 90 U.S. Grade C or U.S. Score 89 General
E.	TECHNICAL BASIS/ CATEGORIZATION:	Flavor is the basic quality factor in grading butter and is determined organoleptically by taste and smell. The flavor characteristic is identified, and together with its relative intensity, is rated according to the applicable classification. Body, color and salt characteristics are then noted and any defects are disrated in accordance with the established classification. The final U.S. grade is then established. The standards are set forth in the code.
F.	LABEL CONTENT:	Same as for "Manufactured or Processed Dairy Products".
G.	PHYSICAL CHARACTERISTICS:	Same as for "Manufactured or Processed Dairy Products".
H.	LOCATION:	Same as for "Manufactured or Processed Dairy Products".
I.	COMMENTS:	Butter is graded on one technical basis (flavor) and then is disrated for other bases (body, color and salt) in accordance with an established scheme, to come up with a final U.S. grade.

13. AGRICULTURAL SEEDS

A.	PRODUCT:	Agricultural Seeds
B.	AGENCY:	Department of Agriculture (7 CFR Part 201)
C.	PURPOSE:	Classification and quality information
D.	GRADE/RATING:	Class of seed
E.	TECHNICAL BASIS/ CATEGORIZATION:	Set forth in code
F.	LABEL CONTENT:	1. Name of each kind of seed present 2. Percent of each kind of seed 3. Variety of seed 4. Type of seed 5. Word "hybrid" if hybrid present 6. Lot number or other identification "I.D." 7. Origin of seed 8. Percentage of weed seeds 9. Percentage of agricultural seeds 10. Percentage of weight of inert matter 11. Percentage of germination for each kind of type/hybrid 12. Percentage of hard seed 13. Month and year germination test was completed 14. "Manufacturer" - Full name and address of either shipper or consignee 15. Inoculated seed must show expiration date for inoculation 16. Grade - Class of seed.
G.	PHYSICAL CHARACTERISTICS:	Not specified
H.	LOCATION:	Tag attached securely to the container, or printed in a conspicuous manner on a side or the top of the container.

I. SPECIAL: The label may contain information in addition to that required by the Act, provided such information is not misleading.

J. COMMENTS: The most important point to note is that all the required information is located on a tag securely attached to the container or printed in a conspicuous manner on the top or side of the container.

It is also interesting that inoculated seed has something analogous to a useful life stamped on the product.

14. SHELL EGGS

A.	PRODUCT:	Shell eggs
B.	AGENCY:	Department of Agriculture (7 CFR 56)
C.	PURPOSE:	Size and quality information
D.	GRADE/RATING:	Eggs are rated By Quality (Grademark): Grade AA (Fresh Fancy) Grade A Grade B Grade C Dirty Check By size: Jumbo Extra Large Large Medium Small Pee Wee The "quality" grade is a composite rating of the shell, air cell, white and yolk.
E.	TECHNICAL BASIS/ CATEGORIZATION:	The standard for individual egg quality and U.S. consumer grades are set forth in the code.
F.	LABEL CONTENT:	1. USDA } within a shield 2. U.S. Grade } 3. Size or weight class may appear (if not must appear prominently on main panel of carton) 4. Plant number may appear (if not must be shown elsewhere on the packaging material).
G.	PHYSICAL CHARACTERISTICS:	Specified as follows: 1. Samples of approved grademarks are shown in the code 2. Size

H. LOCATION: The grademark must be printed on the carton or on the tape used to seal the carton.

I. COMMENTS: The grading system uses and does not combine two grades, one for quality, one for size. The quality grading requires that certain requirements *all* be met to receive a certain grade. The size grade sets a minimum weight per dozen, per 30 dozen, and a minimum weight for individual eggs at rate per dozen. Letter codes are used.

15. PRODUCTS COVERED BY THE "AGRICULTURAL MARKETING ACT OF 1946"

A.	PRODUCT:	Processed fruits and vegetables, processed products thereof, and certain other processed food products (requirements under Agricultural Marketing Act of 1946)
B.	AGENCY:	Department of Agriculture (7 CFR 52)
C.	PURPOSE:	Quality and size information
D.	GRADE/RATING:	U.S. Grade A U.S. Grade B U.S. Grade C This is voluntary grading and labeling.
E.	TECHNICAL BASIS/ CATEGORIZATION:	The grade is a composite rating of various factors such as appearance, ripeness, texture, taste, etc. Standards are set forth in the code.
F.	LABEL CONTENT:	1. Grade (2 forms of label): "Packed under Continuous Inspection of the U.S. Department of Agriculture -- for plants operating under continuous U.S.D.A. inspection. 2. Grade -- contract in plant inspection 3. Officially sampled date - U.S. Department of Agriculture, Washington, D.C. -- contract in plant inspection.
G.	PHYSICAL CHARACTERISTICS:	Specified as follows: The grade and inspection marks approved for use are shown in figures in the code.
H.	LOCATION:	Not specified
I.	COMMENTS:	Processed food has a composite grade, having a technical basis of both subjective and physical parameters. Intervals are not defined in numerical terms. Letter codes are used. The grading and labeling is voluntary.

16. LIVESTOCK, MEATS, PREPARED MEATS AND MEAT PRODUCTS

A.	PRODUCT:	Livestock, meats, prepared meats and meat products (labeling as to quality, no yield)
B.	AGENCY:	Department of Agriculture (7 CFR 53)
C.	PURPOSE:	Quality information
D.	GRADES/RATINGS:	The grade is a single word code, "prime", "choice", "good", "standard", "commercial", "utility", "cutter", "canner", or "cull"; accompanied when necessary by a class designation.
E.	TECHNICAL BASIS/ CATEGORIZATION:	The quality grade is based on separate evaluations of two general considerations: 1. The quality or the palatability - indicating characteristics of lean, and 2. The conformation of the carcass or primal cut. The standards for these evaluations are set forth in the code.
F.	LABEL CONTENT:	"Official identification" 1. USDA } within the shield 2. Grade } 3. Grader's code identification letters (outside the shield)
G.	PHYSICAL CHARACTERISTICS:	Specified as follows: 1. Shield with USDA and grade enclosed (as shown in Figure ___ in the code): 2. The code identification letters of the grader shall appear intermittently outside the shield.
H.	COMMENTS:	The composite grading system combines a number or technical bases, including maturity, marbling and quality. Quasi-descriptive single-word codes are assigned to the ratings.

17. COTTONSEED FOR CRUSHING PURPOSES

A.	PRODUCT:	Cottonseed for crushing purposes
B.	AGENCY:	Department of Agriculture (7 CFR Part 61)
C.	PURPOSE:	Quality control (purity, soundness)
D.	GRADE/RATING:	Basis grade 100 1. High grades are defined as those above 100; 2. Low grades are defined as those below 100; 3. Grades for American Pima cotton shall be suffixed by the designation "American Pima" or by the symbol "AP"; 4. Below grade 40.0 shall be designated as "below grade cottonseed" and a numerical grade shall not be indicated.
E.	TECHNICAL BASIS/ CATEGORIZATION:	Based on numerical "quantity index" (yield) and numerical "quality index". These are multiplied and divided by 100.
F.	LABEL CONTENT:	Numerical grade on certificate.
G.	PHYSICAL CHARACTERISTICS:	Not specified
H.	LOCATION:	Not specified
I.	SUMMARY:	The most interesting point here is the grading system. A basis grade of 100 is set and "high" and "low grades relate to this. This type of scale might be useful with a grade of 100 signifying the greatest amount of noise energy a person can receive without being fully "impacted": a low grade cut-off point is identified.

18. WORKPLACE SIGNS (General Requirements)

A.	PRODUCT:	Workplace signs (general requirements)
B.	AGENCY:	Department of Labor, Occupational Safety and Health Administration (29 CFR Part 1910)
C.	PURPOSE:	To identify hazards
D.	GRADE/RATING:	Not applicable
E.	TECHNICAL BASIS/ CATEGORIZATION:	
F.	LABEL CONTENT:	Symbols used should follow recognized practices (examples given). Wording used is qualitatively specified (examples given).
G.	PHYSICAL CHARACTERISTICS:	1. Colors 2. Proportions 3. Format 4. Sign shape 5. General construction of sign. All spelled out and referenced to ANSI or ASAE standards.
H.	LOCATION:	Qualitatively specified, except in cases of in-plant traffic signs and slow moving vehicle emblems, which are referenced to national standards.

19. WORKPLACE SIGNS AND MARKINGS (Specific Requirements)

A.	PRODUCT:	Workplace signs and markings (specific requirements)
B.	AGENCY:	Department of Labor, Occupational Safety and Health Administration (29 CFR Part 1910)
C.	PURPOSE:	Safety
D.	GRADE/RATING:	Not applicable
E.	TECHNICAL BASIS/ CATEGORIZATION:	
F.	LABEL CONTENT:	See subheading information below: Means of Egress (1910.37) Wording and symbol (arrow) spelled out; Overhead Conveyors (1910.261) - Specific wording "or their equivalent" must be used; Asbestos Air Contaminants - wording specified; Manlift Instruction and Warning Signs (1910.68) - approximate wording given for instructional signs; legend specified for visitor warning sign; Bulk Oxygen Equipment Locations (1910.104) - Specific words or "equivalent"; Transportation Vehicle Carrying Explosives (1910.109) - Marked with class of explosive or oxidizer carried. Additional warning "Dangerous" for vehicle carrying more than a specified weight is necessary;
G.	PHYSICAL CHARACTERISTICS:	See subheadings below: Means of Egress - Size, color and design should be readily visible and distinctive from other signs; Overhead Conveyors - must be erected in accord with ANSI Z35.1-1968; Electromagnetic Radiation Warning Symbol (1910.97) - Color, format, proportions, location of space (or ancillary information specified);

Asbestos Air Contaminant Caution Signs and Labels - Sign size, letter size, style and spacing specified for caution signs, size and contrast of letters qualitatively described for label;
Manlift Signs (1910.68) - Letter size and color specified for instructional signs; letter size, shape and illumination required is specified for top floor warning sign; letter size, shape and contrast specified for visitor warning signs;
Bulk Oxygen Equipment Locations - "permanently placarded";
Transportation Vehicle Carrying Explosives - height, stroke, color and format of signs is specified;
Portable Fire Extinguisher Locations (1910.157) - means shall be provided to conspicuously indicate the location and intended use of extinguishers.

H. LOCATION: See subheadings below:

Asbestos Air Contaminant Caution Signs and Labels - location qualitatively specified;
Transportation Vehicle Carrying Explosives - Specified locations on vehicle.

I. COMMENTS: More important information is specified more fully.

20. WORKPLACE MACHINERY

A.	PRODUCT:	Workplace machinery - tags for hazardous conditions, defective equipment
B.	AGENCY:	Department of Labor, Occupational Safety and Health Administration (29 CFR Part 1910.145)
C.	PURPOSE:	Temporary warning of hazardous conditions or defective equipment
D.	GRADE/RATING:	Not applicable
E.	TECHNICAL BASIS/ CATEGORIZATION:	
F.	LABEL CONTENT:	Symbols are specified for radiation and biohazards.
G.	PHYSICAL CHARACTERISTICS:	Color and format specified for some tags ("do not start", "radiation" and "biohazards").
H.	LOCATION:	Location specified for "do not start", "danger", and "caution" tags.

21. GASOLINE

A.	PRODUCT:	Gasoline
B.	AGENCY:	Federal Trade Commission (16 CFR 422)
C.	PURPOSE:	Octane information at the pump
D.	GRADES/RATINGS:	A single number octane grade derived by method set forth in the code and termed "octane number".
E.	TECHNICAL BASIS/ CATEGORIZATION:	The "octane number" is calculated from the research octane number and the motor octane number, which are in turn determined from tests described in ASTM D439-70 and ASTM D2699 and D2700.
F.	LABEL CONTENT:	Minimum "octane number" of the motor gasoline being dispensed must appear on the pump.
G.	PHYSICAL CHARACTERISTICS:	Specified as follows: 1. Permanently attached 2. Conspicuous
H.	LOCATION:	Conspicuously located on the gasoline pump.
I.	COMMENTS:	The FTC octane number is a combination of industry standards and a standard set forth in the code. PROBLEM: The octane number in car owners' manuals at the time of the rulemaking was the research octane number. In 1974, the auto industry came up with a symbol which indicates the range of octane appropriate for the vehicle. The symbol is meaningless to the consumer since it has no obvious relation to the number that is posted on the gasoline pump. In 1975, the auto industry decided to print in car owners' manuals the research octane number, the FTC octane number and the octane symbol, making no mention of which octane rating is found on the gasoline pump.

22. FULL-SIZE BABY CRIBS

A. PRODUCT: Full-size baby cribs

B. AGENCY: Consumer Products Safety Commission (16 CFR 1508)

C. PURPOSE: Safety, Warnings and Instructions

D. GRADE/RATING: } Not graded. Safety standards are set
E. TECHNICAL BASIS/ } forth in the code.
CATEGORIZATION: }

F. LABEL CONTENT:

1. Name and place of business of the manufacturer, importer, distributor, and/or seller;
2. Model number, stock number, catalog number, item number or other symbol expressed numerically, in code or otherwise, such that only articles of identical construction, composition and dimensions shall be identical in markings;
3. The following warning: "Caution" Any mattress used in this crib must be at least 27-1/4 inches by 51-5/8 inches, with a thickness not exceeding six inches or the equivalent statement with dimensions given in centimeters;
4. Statement of conformance to applicable regulations promulgated by the CPSC;
5. Assembly instructions for cribs shipped other than completely assembled.

The instructions shall also include:

a) Cautionary statements concerning secure tightening and maintaining of bolts and other fasteners;
b) Cautionary statement on maximum height for child using crib;
c) Mattress size warning statement.

G. PHYSICAL CHARACTERISTICS:

1. Size of type of warning (minimum).
2. Style of type of warning.
3. Warning must contrast sharply with the background of the label.
4. Markings on crib shall be of a permanent nature.
5. Markings shall not be readily removable or subject to obliteration during normal use or when the article is subjected to reasonably foreseeable damage or abuse.

H. LOCATION:

The label contents (items 1 - 4) must be clearly and conspicuously visible on the crib under normal conditions of retail display. The label contents (items 1 - 4) must also be clearly marked on the retail carton.

I. COMMENTS:

The label herein is primarily for proper assembly and use of the crib.

It is important to note that the code requires that label content (items 1 - 4) be clearly visible under normal retail conditions.

23. LIGHT-DUTY MOTOR VEHICLES, HEAVY-DUTY GASOLINE ENGINES

A.	PRODUCT:	Light-duty motor vehicles, heavy-duty gasoline engines
B.	AGENCY:	Environmental Protection Agency (40 CFR Part 85)
C.	PURPOSE:	Provide emission control maintenance information
D.	GRADE/RATING:	Not applicable
E.	TECHNICAL BASIS/ CATEGORIZATION:	
F.	LABEL CONTENT:	1. Heading - "Vehicle Emission Control Information" 2. Full corporate name and trademark of manufacturer 3. Engine displacement and family 4. Tune-up specs and adjustment (specified) along with indication of what the transmission position should be and what accessories should be operative during tune-up 5. A conformance standard (specified)
G.	PHYSICAL CHARACTERISTICS:	1. Constructed of plastic or metal that is permanently attached so that it cannot be removed without being destroyed. 2. Letter shape, language and color contrast specified.
H.	LOCATION:	Vehicle-engine compartment; engines-on engine
I.	COMMENTS:	This kind of information label provides not only instruction but also serves to establish a legal basis for compliance; hence the contents and stipulations are pre-established and impressed more vigorously than for purely information labels.

24. REFRIGERATORS, REFRIGERATOR-FREEZERS AND FREEZERS

A.	PRODUCT:	Refrigerators, refrigerator-freezers, and freezers
B.	AGENCY:	Department of Commerce
C.	PURPOSE:	Consumer information on energy consumption and cost of operation to promote and effect energy conservation.[1]
D.	GRADE/RATING:	Not graded per se, but systems are grouped by volume. The energy consumption and cost of operation per month of a particular system is reported, and the range of values for its volume class are given.
E.	TECHNICAL BASIS/ CATEGORIZATION:	1. Total Refrigerated Volume: ANSI B38.1 - 1970 Section 3.2 2. Energy Consumption: Home Appliance Manufacturers Standard HRF-2-ECFT-1974.
F.	LABEL CONTENT:	1. Heading: "Energy Guide" 2. Symbol: U.S. Department of Commerce Energy Conservation Mark 3. System type, Model No. and Size 4. Energy consumption per month 5. Notice of where energy saving information may be obtained 6. Comparison Information: ranges of energy consumption and cost of operation for volume group.

[1] McGuire, B.J. and E.A. Vadelind, "Voluntary Labeling Program for Household Appliances and Equipment to Effect Energy Conservation," Annual Report for Calendar Year 1974. NBSIR 75-660, February, 1975. Draft Analysis of Comments to Notice Published in Federal Register December 31, 1974, 39 FR 45334.

G. PHYSICAL CHARACTERISTICS:

The label appearance is completely specified and camera-ready art suitable for printing (except lacking the required data) shall be provided by the Secretary (in tag form). Appearance in catalog or advertising brochure, where the information must also appear, is not specified.

Physical characteristics specified are:
1. Size, style and color of type
2. Symbol
3. Color of stock
4. Size of label
5. Layout of label
6. Method of attachment.

H. LOCATION:

Specified as follows:
1. Vertical systems: label to be hung from the top shelf or four feet up on the inside of the door.
2. Chests: label is to be hung from the inside of the lid.

I. COMMENTS:

If a new model of an appliance is introduced, which is cheaper to operate than is indicated by the lower range of operating costs, the manufacturer is encouraged to advertise that fact.

The selection of room air conditioners, also labeled in the overall DOC program, was found to be so complex that the decision was made to incorporate the pertinent information into a brochure, rather than have the information appear on the label per se. The EPA has statutory authority to consider such alternatives in its noise labeling program.

The inclusion of comparative information on the label, as an incentive to both the consumer and the manufacturer to consider better performing products, is unique and merits EPA consideration.

25. TEXTILE WEARING APPAREL AND YARD GOODS

A.	PRODUCT:	Textile wearing apparel and yard goods
B.	AGENCY:	Federal Trade Commission (16 CFR 423)
C.	PURPOSE:	Disclosures for care and maintenance
D.	GRADE/RATING:	Not graded. Maintenance and care instructions must be given.
E.	TECHNICAL BASIS/ CATEGORIZATION:	The maintenance and care instructions required are those necessary for ordinary use and enjoyment of the article.
F.	LABEL CONTENT:	1. Instructions for care and maintenance 2. Warnings when normal care procedure associated with that article will, in fact, if applied, substantially diminish the ordinary use and enjoyment of the article.
G.	PHYSICAL CHARACTERISTICS:	1. Permanently affixed to a finished article of wearing apparel 2. Remain legible for useful life of article 3. For yard goods, can be permanently affixed to finished article using normal household methods.
H.	LOCATION:	Finished article of wearing apparel: Label must be permanently attached to article. Yard goods: Label must accompany goods.
I.	COMMENTS:	The care and maintenance labeling program has had some problems at the consumer end. At times finished articles of clothing if washed and dried according to instructions will shrink or run or become misshaped. Also, when purchasing yard goods, it is common not to receive a care label with the goods.

SECTION 2

NOISE LABELING - GENERAL APPROACH

The labeling of consumer products is an area of governmental regulation that is growing. Certain consumer products like motorcycles now have several labels, and others are proposed or under development. Unless care is taken, these separate labeling efforts will appear totally uncoordinated, and the consumer may be confused and antagonized by the clutter of different messages, symbols, and warnings.

TYPES OF LABELS

Table 2-1 lists the various kinds of labels that are attached to products for regulatory purposes, putting aside entirely voluntary manufacturer labeling. By "regulatory" it is meant that the label is put there in accordance with some established rule or standard. The regulator need not be the government, nor must use of the standard be governmentally required. Some examples in the listed categories are:

- Governmental requirements: mandatory labeling rules established by EPA, NHTSA, FDA, USDA, FTC, etc.
- Governmental permission: EPA/FEA fuel economy - in this case, a vehicle manufacturer may choose not to label. If he does label, it must conform to specific requirements.
- Trade association rules: such organizations as BIA (Bicycles), OPEI (power lawn mowers), ARI (central

air-conditioners) allow use of seals and labels to indicate specific performance measures.

- Others: such magazines as *Good Housekeeping* and *Parents* have approval programs, usually without a publicly disclosed test basis, and the Snell Foundation has a voluntary crash helmet standards program.

Table 2-1

Types of Labels

LABELS ARE ATTACHED TO PRODUCTS FOR "REGULATORY" PURPOSES UNDER:

- GOVERNMENT REQUIREMENT
- GOVERNMENTAL PERMISSION
- TRADE ASSOCIATION RULES
- OTHER - INCLUDING SEALS OF APPROVAL OF MAGAZINE PUBLISHERS

INFORMATION LABELING

The various kinds of labeling shown in Table 2-1 can be further categorized, as shown in Table 2-2, as being either conformance labeling or informational labeling. Labeling to claim compliance has been investigated in connection with EPA product noise emission standards, but will not be discussed in this report which is concerned only with informational labeling.

Table 2-2

Conformance Labeling and Information Labeling

CONFORMANCE LABELING - TO CLAIM COMPLIANCE WITH GOVERNMENTAL OR PRIVATE STANDARDS OF PERFORMANCE REGS

- LABELING OF THIS TYPE, WHICH EPA MAY DO UNDER SECTION 6 OF THE ACT, IS NOT OF INTEREST HERE

INFORMATIONAL LABELING - PROVIDES ESSENTIAL INFORMATION TO PURCHASER/USER

- QUALITY GRADES
- PERFORMANCE
- USE INSTRUCTIONS
- HAZARDS
- LEGAL REQUIREMENTS RELATED TO THE INFORMATION LABEL
- THIS TYPE OF LABELING IS TO BE DONE UNDER SECTION 8 OF THE ACT

The goal of informational labeling is to say to the prospective purchaser or user: "Look here for noise information about this noise producer or noise reducer." This information must appear to be -- and indeed must be -- more than self-serving, unregulated advertising. The label should convey the message that the contents are "Government approved" or "Government checked" and thus trustworthy and unprejudiced.

Table 2.3 shows those agencies whose labeling regulations have been examined.

Many of these agencies are responsible for labeling more than one product category.

Table 2-4 indicates the wide variety of items labeled by the Federal Government.

Label requirements have been accompanied by public-information campaigns -- sometimes undertaken by the regulatory agency alone, as in the example shown in Fig. 2-1.

The public information process is greatly aided if industry itself joins in the effort. Fig. 2-2 shows covers to brochures -- the right-hand one published at Government expense by the FDA, the left-hand one, which makes very effective use of color printing, by a large retail food chain.

The clarity of the explanations given to consumers varies. Fig. 2-3 shows the label information one should expect to find on cheese and explains the terms used by the industry.

Fig. 2-4 shows a catalog entry that includes a noise rating (2.9 sones). However, the explanation headed *Ventilator Note* is obscure and confusing to the lay public, and indeed, to a sample of acoustical engineers.

These same people also had difficulty understanding the advertisements shown in Fig. 2-5. Everyone, expert and lay-person alike, was dismayed that the ventilation quietness rating and the air conditioner sound rating were not on the same basis and that no meaningful comparison could be quickly made. Worse yet, these values could not readily be related to the sound levels in decibels, with which the public is becoming increasingly familiar.

Table 2-3

Federal Agencies Involved in Labeling

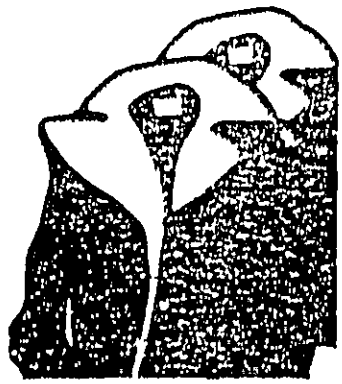
Atomic Energy Commission
Consumer Product Safety Commission
Department of Agriculture
Department of Commerce
Department of Defense
Department of Justice
Environmental Protection Agency
Federal Energy Commission
Federal Trade Commission
Food and Drug Administration (HEW)
National Highway Traffic Safety Administration (DOT)
Occupational Safety and Health Administration (DOL)

Table 2-4

Examples of Specific Products and General Categories
Subject to Labeling Laws

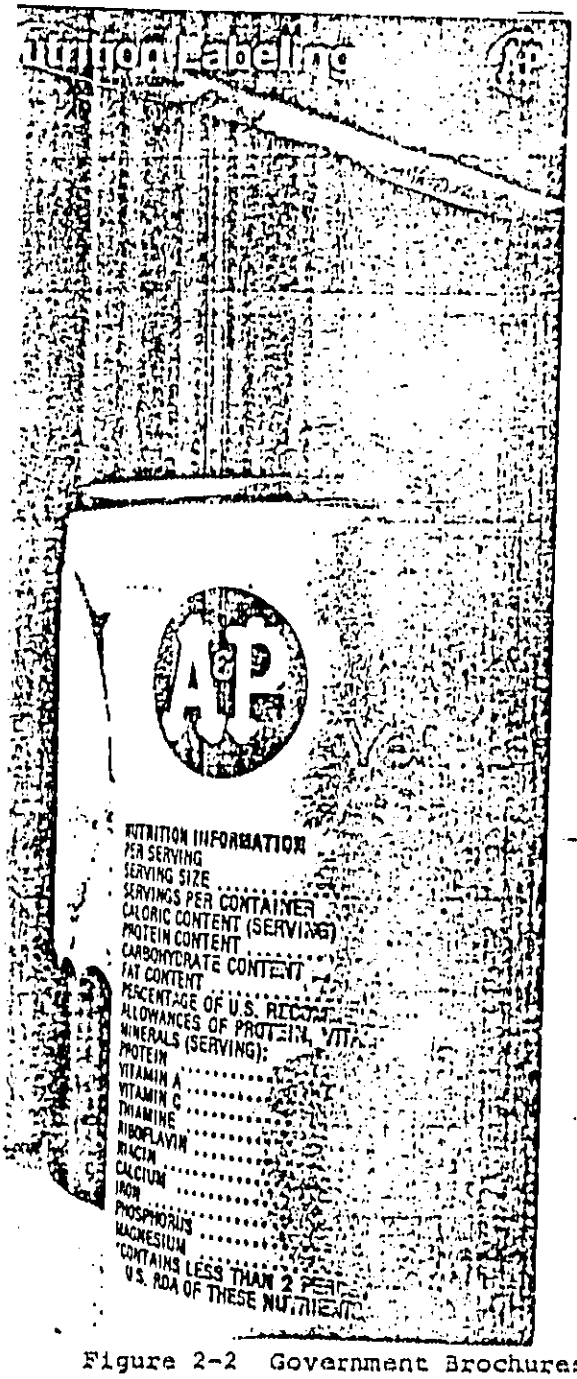
Tires
Electrically operated toys
Charcoal briquettes
Air conditioners
Lawn darts
Toy caps
Bicycles
Car seats for children
Power amplifiers
Refrigerators, freezers
Textile wearing apparel and yard goods
Full-size cribs
Hazardous substances
Insecticides, fungicides and rodenticides
Gasoline
Cigarettes
Drugs
Food
Light bulbs
Motor vehicles
Electric appliances
Upholstered products
Agricultural seed
Occupational safety equipment

FTC Buyer's Guide No. 6



LOOK FOR
THAT LABEL

Figure 2-1



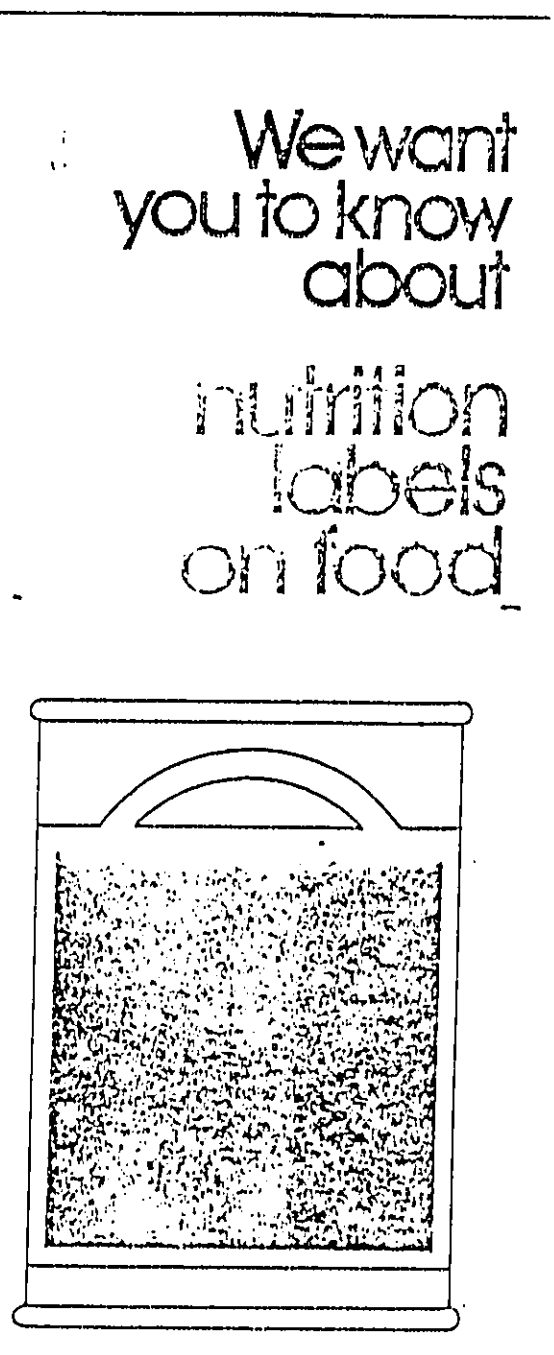


Figure 2-2 Government Brochures

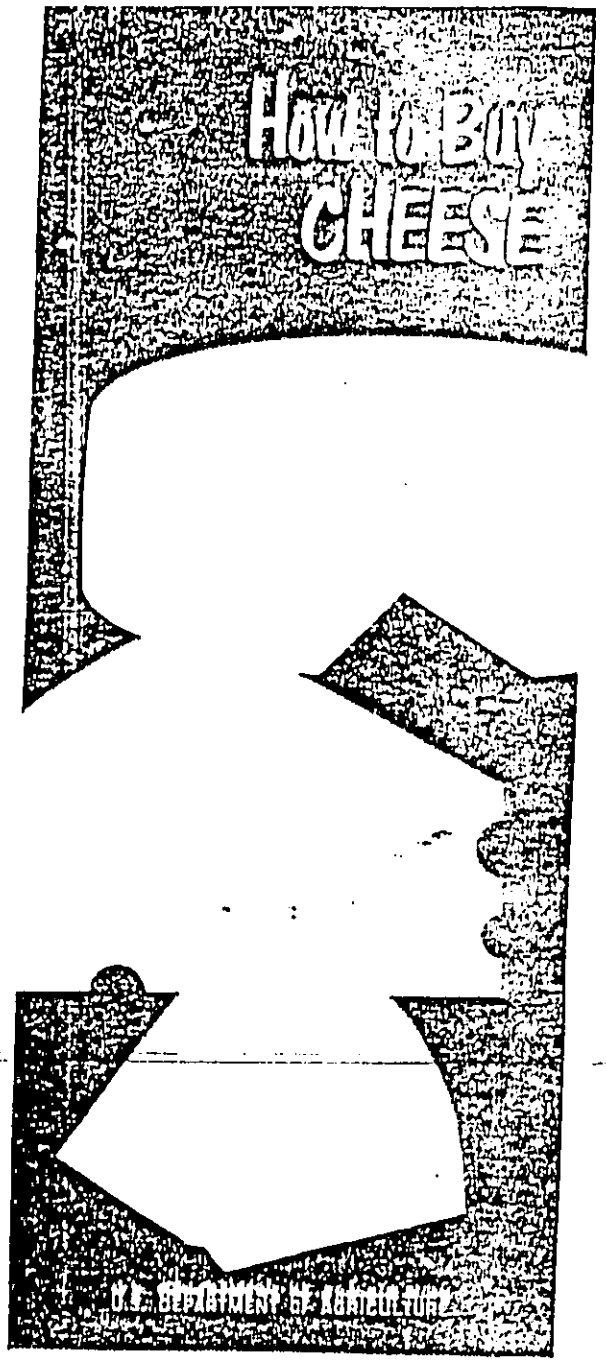


Figure 2-3 Cheese Labels

BUYING CHEESE

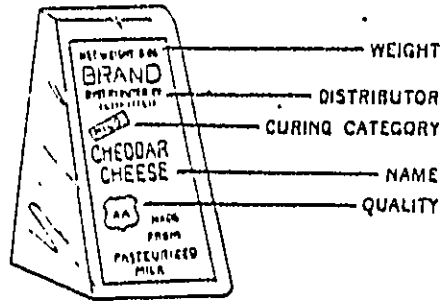
CHECK THE LABEL

The labels of natural cheese, pasteurized process cheese, and related products carry important descriptive information. The name of a natural cheese will appear as the variety such as "Cheddar cheese", "Swiss cheese", or "Blue cheese."

Pasteurized process cheese labels will always include the words "pasteurized process", together with the name of the variety or varieties of cheese used, for instance, "pasteurized process American cheese" or "pasteurized process Swiss and American cheese".

Cheese food also contains ingredients other than cheese and therefore is labeled as "pasteurized process cheese food". Cheese spreads have a different composition from cheese foods and are labeled as "pasteurized process cheese spread". All the ingredients used in the preparation of these products are listed on the respective label along with the kinds or varieties of cheese used in the mixture. Also the milkfat and moisture content may be shown.

Coldpack cheese and coldpack cheese food are labeled in the same manner as other cheese and cheese foods except that "club cheese" or "comminuted cheese" may be substituted for the name "coldpack cheese".

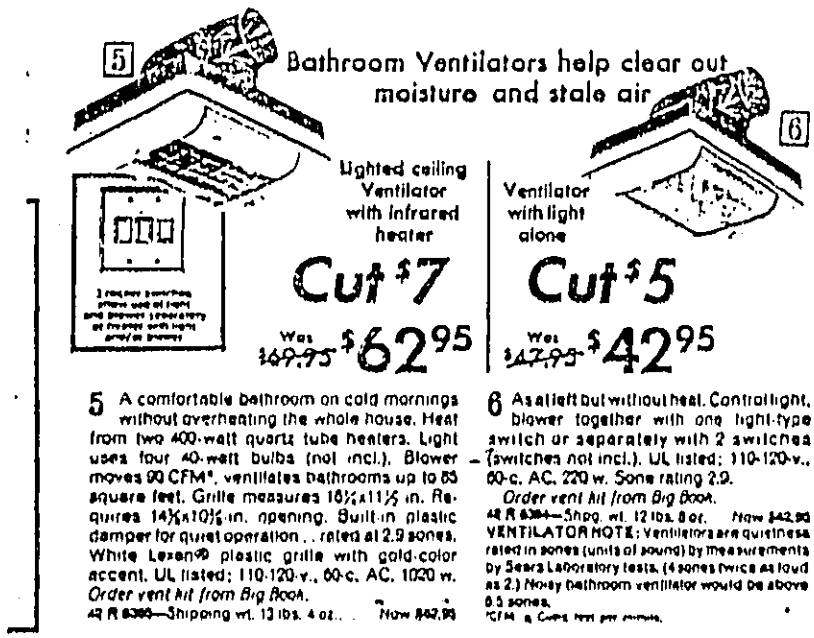


CHECK THE CURE

A very important bit of information on the label of certain varieties of natural cheese pertains to the age or degree of curing. For instance, Cheddar cheese may be labeled as "mild", "medium" or "mellow", or "aged" or "sharp". In some cases pasteurized process cheese may be labeled to indicate a sharp flavor when a much higher proportion of sharp or aged cheese was used in its preparation.

CHECK THE NAME

Look for the name of the article. Do not confuse the brand name with the name of the cheese. For some purposes you may want natural cheese.



5

Bathroom Ventilators help clear out moisture and stale air

6

Lighted ceiling Ventilator with infrared heater

Cut $7

Was ~~$69.95~~ $62.95

Ventilator with light alone

Cut $5

Was ~~$47.95~~ $42.95

5 A comfortable bathroom on cold mornings without overheating the whole house. Heat from two 400-watt quartz tube heaters. Light uses four 40-watt bulbs (not incl.). Blower moves 90 CFM*, ventilates bathrooms up to 65 square feet. Grille measures 16⅞x11⅝ in. Requires 14⅝x10⅜-in. opening. Built-in plastic damper for quiet operation . . rated at 2.9 sones. White Lexan® plastic grille with gold-color accent. UL listed; 110-120-v., 60-c. AC, 1020 w. *Order vent kit from Big Book.*
42 R 8366—Shipping wt. 13 lbs. 4 oz. . . Now $42.95

6 As at left but without heat. Control light, blower together with one light-type switch or separately with 2 switches (switches not incl.). UL listed; 110-120-v., 60-c. AC, 220 w. Sone rating 2.9.
Order vent kit from Big Book.
42 R 8364—Shpg. wt. 12 lbs. 8 oz. Now $42.95
VENTILATOR NOTE: Ventilators are quietness rated in sones (units of sound) by measurements by Sears Laboratory tests. (4 sones twice as loud as 2.) Noisy bathroom ventilator would be above 6.5 sones.
*CFM = Cubic feet per minute.

Figure 2-4 Example of a Noise Rating

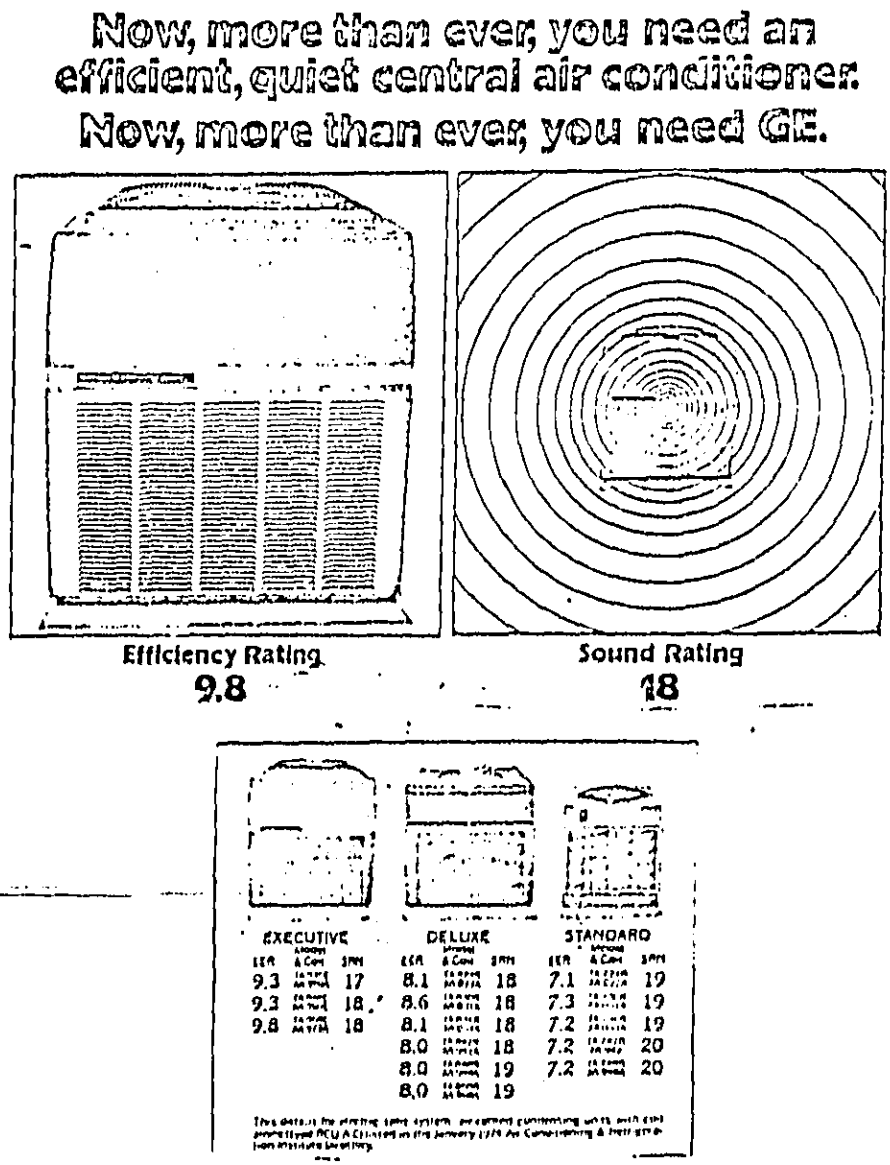


Figure 2-5 Advertisements for Air Conditioners

NOISE LABELING UNDER SECTION 8 OF THE NOISE CONTROL ACT

It is now appropriate to examine the labeling task that Congress has set forth for the EPA. The Noise Control Act of 1972 devotes all of Section 8 and part of Section 10 to labeling. Section 8 is shown in Table 2-5.

Table 2-6 is an exerpt from Section 10.

Table 2-5

Section 8 of the Noise Control Act of 1972
(Public Law 92-574) (Labeling)

(a) The Administrator shall by regulation designate any product (or class thereof) -

(1) which emits noise capable of adversely affecting the public health or welfare; or
(2) which is sold wholly or in part on the basis of its effectiveness in reducing noise.

(b) For each product (or class thereof) designated under sub-section (a) the Administrator shall by regulation require that notice be given to the prospective user of the level of the noise the product emits, or of its effectiveness in reducing noise, as the case may be. Such regulations shall specify (1) whether such notice shall be affixed to the product or to the outside of its container, or to both, at the time of its sale to the ultimate purchaser or whether such notice shall be given to the prospective user in some other manner, (2) the form of the notice, and (3) the methods and units of measurement to be used. Sections 6(c) (2) shall apply to the prescribing of any regulation under this system.

(c) This section does not prevent any State or political subdivision thereof from regulation product labeling or information respecting products in any way not in conflict with regulations prescribed by the Administrator under this section.

Table 2-6

Section 10 of the Noise Control Act of 1972

(Public Law 92-574) (Labeling)

(a) Except as otherwise provided in subsection (b), the following acts or the causing thereof are prohibited:

.

.

.

(3) In the case of a manufacturer, to distribute in commerce any new product manufactured after the effective date of a regulation prescribed under Section 8(b) (requiring information respecting noise) which is applicable to such product, except in conformity with such regulation.

(4) The removal by any person of any notice affixed to a product or container pursuant to regulations prescribed under Section 8(b), prior to sale of the product to the ultimate purchaser.

In Table 2-7, the language of Section 8 is examined in more detail.

As indicated in Note 2, if the EPA identified a noise hazard from a product that was no longer made, it could identify it for labeling purposes, although notifying the user could present practical difficulties. Interaction with other State and local governments could be useful here.

As indicated in Note 3, the specification as a group of all products capable of adverse effect could shorten the regulatory timetable.

The information necessary to make the determination concerning adverse effects is already available, in part, as contained in the following EPA Publications: "Public

Health and Welfare Criteria for Noise", July 27, 1973 [1] and "Information on Levels of Noise Requisite to Protect Public Health and Welfare with an Adequate Margin of Safety", March, 1974 [2].

For example, as indicated in Note 5., the METRO transit system will expose riders and spectators to noise. Home air conditioner noise can affect both the owner and his neighbors.

Figure 2-6 is an example of advertisements for grass seed which incorporates a noise claim!

Table 2-8 contains an examination of Section 8(B) of the Statutory Authority.

As indicated in Note 9., the legislative history shows that various and sometimes more specific requirements were part of the several noise control bills introduced in the Congress in 1971.

How can the term label be defined? Table 2-9 shows one definition, drawn from a pesticide regulation. It is too specific for the purposes under discussion.

As shown by Table 2-10, labeling means different things to different people. Most of the differences come from the different perception of labeling as seen in government, in industry, in the engineering department, or in the graphics or advertising department. Labeling is really all of those things.

Table 2-7

Statutory Authority

SECTION 8(A) REQUIRES[1] THE ADMINISTRATOR TO . . . DESIGNATE ANY PRODUCT[2] (OR CLASS THEREOF)[3]

(1) WHICH EMITS NOISE CAPABLE[4] OF ADVERSELY AFFECTING THE PUBLIC HEALTH AND WELFARE[1,5] . . ."

". . . SHALL DESIGNATE ANY PRODUCT (OR CLASS THEREOF)

(1) WHICH EMITS NOISE CAPABLE[4] OF ADVERSELY AFFECTING[5] . . ."

(2) WHICH IS SOLD WHOLLY OR IN PART[6] ON THE BASIS OF ITS EFFECTIVENESS IN REDUCING NOISE"

---

[1] "Shall . . . designate any" Note no discretionary authority, as in Section 6(a)(3) is provided.

[2] The product need not be a "new product" as defined in Section 3(5).

[3] The designated product could be specific . . . (e.g., Whisper jet 727) . . . or generic . . . (e.g., chain saws with gasoline engines) . . . or all products capable of adverse effect on public health and welfare as determined by
- information on the levels of noise requisite to protect the public health and welfare (w/o margin of safety)
- the noise exposure in normal use or in expected use.

[4] Products not capable of such adverse effect are not subject to labeling under Section 8(a)(1). A manufacturer's claim to "no adverse effect" can be reviewed under Section 10(a)(3), however, and is subject to FTC review on the issues of unfairness and deception (Section 5, FTCA).

[5] No distinction is made between "prospective users" and "spectators, bystanders".

[6] Again, the product may be designated as an individual, a class, or all products sold on such a basis (e.g., Fylking grass seed, all hearing protectors, all products that either:

Absorb Sound OR Block (attenuate) Sound.

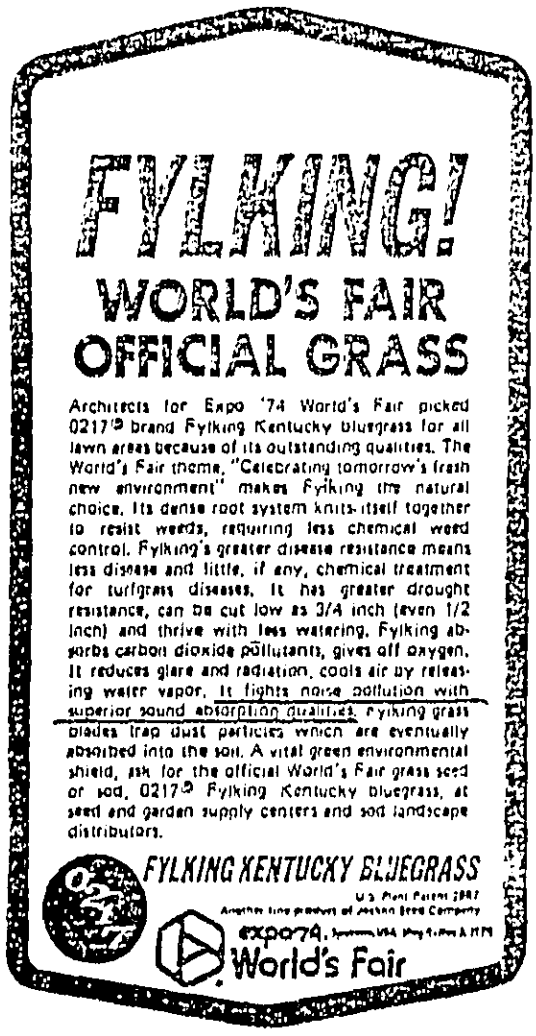


Figure 2-6 Advertisement Incorporating Noise Claim

Table 2-8

Additional Examination of Section 8 Authority

SECTION 8(B) REQUIRES NOTICE[7] TO THE PROSPECTIVE USER[8] OF LEVEL OF NOISE[9] . . . OR ITS EFFECTIVENESS[10] IN REDUCING NOISE.

THE REGULATIONS MUST SPECIFY

(1) WHERE (LOCATION) - ON PRODUCT, ON CONTAINER AT TIME OF SALE TO ULTIMATE PURCHASER -- OR IF NOTICE IS TO BE GIVEN TO THE USER IN ANOTHER WAY

(2) THE FORM

(3) THE METHOD OF MEASUREMENT AND THE UNITS OF MEASUREMENT

---

[7] Not necessarily a label

[8] This is not the "ultimate purchaser" defined in Section 3 (c)

[9] Not necessarily decibels - some "legislative history"

[10] No legislative history

Table 2-9
Definition of Terms

1. LABEL - THE TERM 'LABEL' MEANS THE WRITTEN, PRINTED, OR GRAPHIC MATTER ON, OR ATTACHED TO, THE PESTICIDE OR DEVICE OF ANY OF ITS CONTAINERS OR WRAPPERS.

2. LABELING - THE TERM 'LABELING' MEANS ALL LABELS AND ALL OTHER WRITTEN, PRINTED, OR GRAPHIC MATTER:

   a. Accompanying the pesticide or device at any time; or

   b. To which reference is made on the label or in literature accompanying the pesticide or device, except to current official publications of the Environmental Protection Agency, the United States Departments of Agriculture and Interior, the Department of Health, Education, and Welfare, State experiment stations, State agricultural colleges, and other similar Federal or State institutions or agencies authorized by law to conduct research in the field of pesticides.

Table 2-10
Various Meanings of Term "Labeling"

LABELING CAN MEAN:

- THE WORDS/SYMBOL THAT PROVIDE THE IDENTITY FOR NOISE LABELING
- THE RATING ITSELF
- THE LABEL ON THE PRINCIPAL DISPLAY PANEL -- AND WHAT IS ON THE INFORMATION (SECONDARY) PANEL
- THE TOTALITY OF THE INFORMATION REQUIRED UNDER A LABELING STATUTE

Unfortunately, however, the informative labeling such as is being discussed sometimes is lost in the midst of other labeling as demonstrated in Figure 2-7.

It can be concluded, as shown in Table 2-11, that, on the basis of investigations of both technical (acoustical) factors and graphics considerations, some basic development can be common to labels for noise reducers and noise producers. These common factors will be described in more detail below.

However, noise reducers do not appear to lend themselves to a common label grade, and the separation into a sound insulator and a sound absorber category seems necessary.

MAJOR CHARACTERISTICS OF LABELS

Section 8 identifies three major characteristics which labels

need to specify. They are:

1. Content
2. Physical Characteristics
3. Location

Each of these will be examined in turn.

LABEL CONTENT

The content of the label is of primary importance. However, the content of the label is restricted by two considerations: the limits on the statutory authority and the physical space limitations for messages of readable size and layout. Table 2-12 lists various informational elements of importance. First, the noise label must identify itself. This must be so standardized that it is a highly recognizable symbol. It can be a word or two - STOP has become an international traffic sign symbol, and is recognized in the U.N. Convention on road signing for use in non-English-speaking countries. To gain this near-instant recognizability, it must always appear in the same type-face and the same relationship - both relative size and position - on the label. The words NOISE RATING can become a symbol.

The rating comes next. The discussion to follow will indicate the way any valid but highly technical acoustic measure can be transformed into a simple rating for the layperson.

Since space is at a premium, the next item tells where information essential to getting and keeping the proper noise performance can be found, and information for the technically sophisticated buyer as well.

The manufacturer's name and the product's identification will be required on the noise label only if this does not appear elsewhere - it usually will be elsewhere.

A prohibition against removing the label, and an Agency seal would be at the bottom. This authority symbol must be carefully chosen, for it plays an important role in the reader's mind. Consumer research has shown that the public responds well to "seals of approval" and other official symbols. As mentioned earlier, it is vital that the public see this label's information as trustworthy and impartially determined.

Table 2-11

Common Factors for Labels

1. CAN THERE BE A SINGLE "LABEL" FOR BOTH NOISE PRODUCERS AND NOISE REDUCERS?

   Not Completely - But Many Common Elements Are Possible.

2. CAN THERE BE A SINGLE "LABEL" FOR ALL NOISE PRODUCERS?

   Appears Possible

3. CAN THERE BE A SINGLE "LABEL" FOR ALL NOISE REDUCERS?

   No - Two Major Categories Appear Possible.

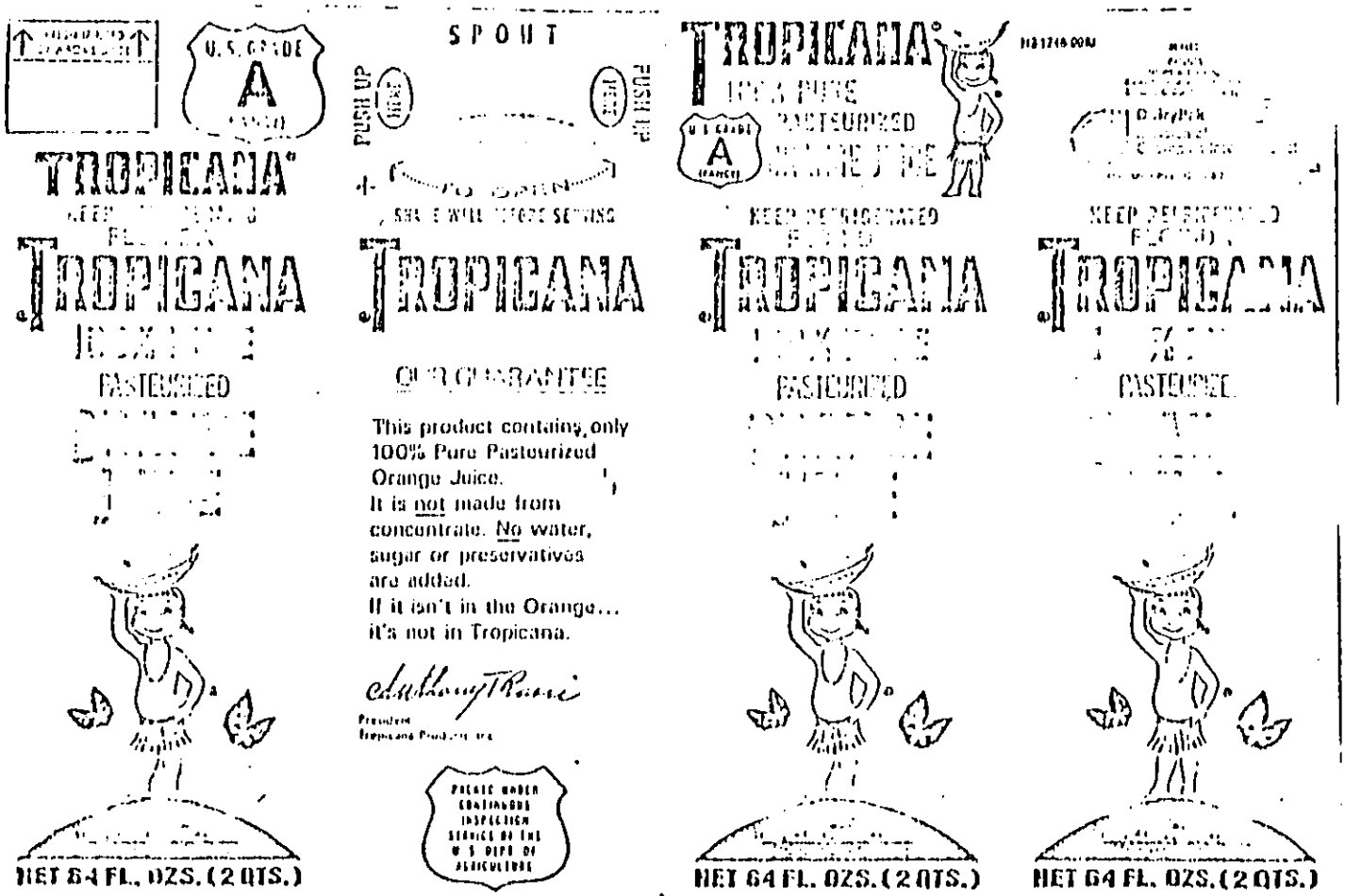


Figure 2-7 Example of Labeling Confusion

Table 2-12

Content of Labels

1. HEADING - NOISE INFO SYMBOL
2. NOTICE OF PERFORMANCE
   - PRODUCER RATING
   - REDUCER RATING
3. REFERENCE TO PRODUCT INSTRUCTIONS, SPECIFICATIONS
   - USE
   - REPAIR, MAINTENANCE
   - DETAILED TECHNICAL SPECIFICATIONS
4. PROHIBITED ACTS
5. MANUFACTURER'S NAME (NOT TRADEMARK), ADDRESS
6. PRODUCT IDENTIFICATION: MODEL, BATCH
7. GOVERNMENTAL AGENCY OR U.S. GOVERNMENT SYBMOL

PHYSICAL CHARACTERISTICS

As demonstrated in Figure 2-8, some seals have become well known to the public through frequent exposure. Even though all these seals represent the same governmental agency and are all based on a shield shape, there are significant appearance variations that can create doubt as to which is the official one. The EPA seal does not use a shield, and contains several symbolic elements - none of which has strong connotations of governmental authority.

In the highly competitive visual world of corporate identity and product trademark advertising, many governmental agency seals fare poorly. In the following exerpt from a U.S. Government publication, the authors note that official seals are often filled with obsure phrases and symbols.

LAND O LAKES®

Sweet Cream
BUTTER
FOUR QUARTERS

AA

Distributed by Land O'Lakes Inc., Minneapolis, MN 55413

U.S. EXTRA GRADE

QUALITY APPROVED

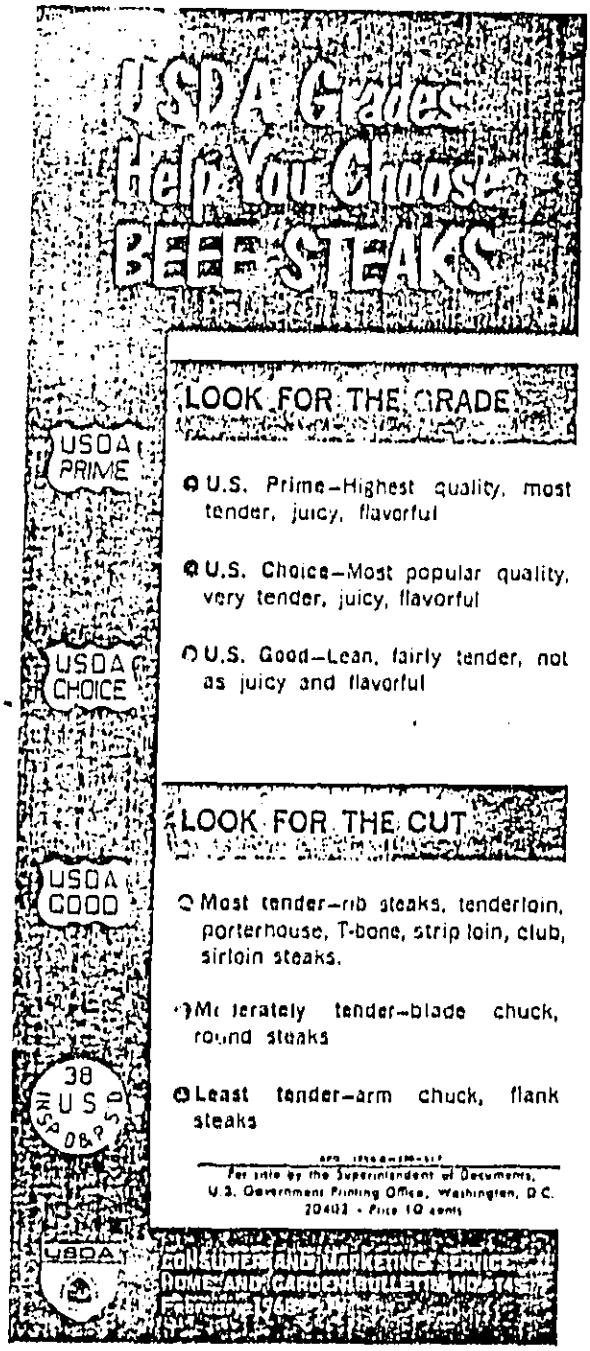


Figure 2-8 USDA Seals

It is interesting to read what the U.S. Department of Health, Education, and Welfare has to say about seals.* (The new seal appears in Figure 2-9.)

> "Government papers quite commonly have seals of various descriptions because one associates seals with important institutions. But a seal is very rarely read by anyone.
>
> "Here we have taken the HEW seal which appears on all letterheads, and we have blown it up to large size. The first thing we note is that the words on the seal are exactly the same as those on the letterhead. Then we find a phrase in Latin, which few of us can read. Then there is the familiar eagle, the caduceus (a serpent on a rod), which has been the medical symbol for a long time. It is not clear exactly what the chain means, but it must have something to do with welfare or education. The symbolism is not clear, but it doesn't matter, because the only real function of the seal is to suggest Government power and status."

Appearance variations in supposedly identical seals, and obscure graphic elements are bad enough when only one governmental agency is involved. Having various symbols for different agencies may be even more confusing. In some ways, therefore, it would be advantagous for there to be <u>one</u> Federal symbol that can achieve and keep quick recognizability, even when restricted to a small size. This would not prevent the name of the agency from appearing as well. However, no such inter-agency symbol exists at present.

Ideally, a symbol should have only one meaning, not two. For example, it was found that the Skull and Cross-Bones "Poison" label actually attracted children, who associated the symbol with pirate games and TV cartoons, rather than sickness.

---

*"How to See," U.S. Department of HEW (Social Security Administration) Publication (SSA) 73-10063.

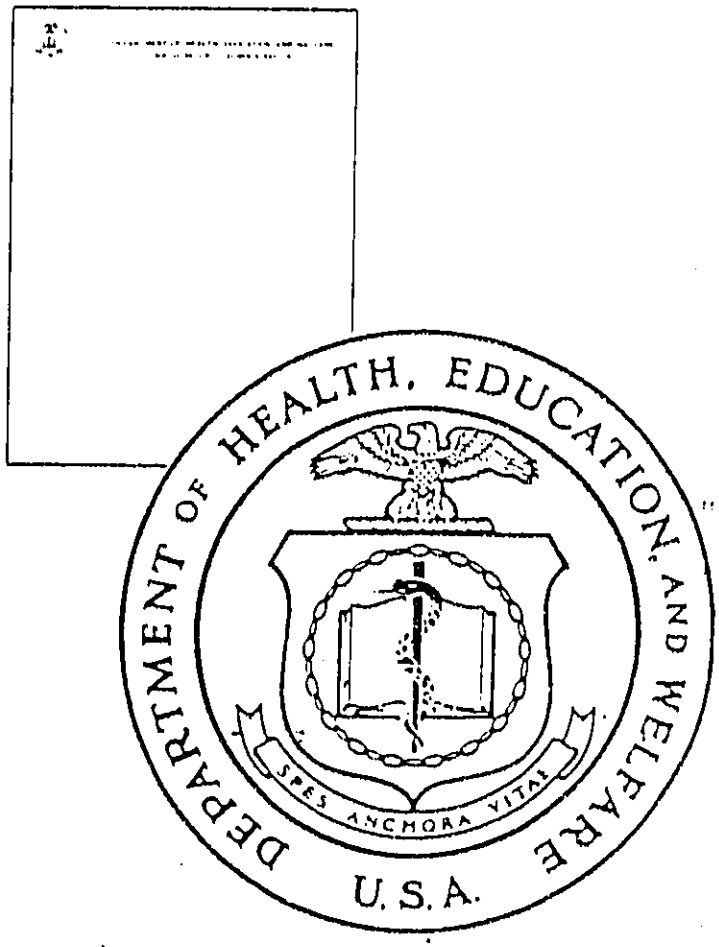


Figure 2-9 HEW Seal

That's why the "Mr. Yuk" symbol shown in Figure 2-10 was developed; children (and adults) understand it as conveying the idea of bad taste or repulsion. It is noteworthy that this symbol (and its sickly green color) have been copyrighted. This was done precisely so that it could not be legally used for other than its intended purpose, for example, in a game or toy for children.

The information conveyed by the label itself is not the whole story.

As specified in Table 2-13, additional instructions may need to be provided to the consumer, perhaps in separate booklets, instruction sheets, etc.

Education of the consumer about the meanings of the various ratings is particularly important if he or she is to understand the full message of the label.

Labeling regulations may have to specify that that these kinds of information be furnished as well. This could be done on a secondary panel on the container, on a separate leaflet packed inside, or in the instruction book.

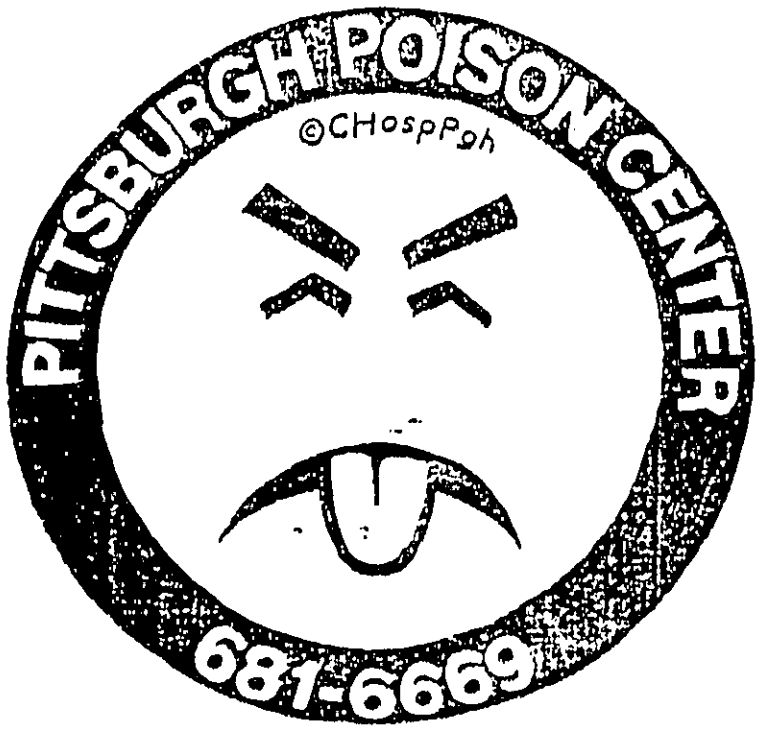


Figure 2-10 Mr. Yuk

The matter of consumer education about the ratings is vital. In theory, it may be accomplished by point-of-sale displays, advertising, or booklets. One problem is how readily this additional information reaches the consumer, and how likely it is to be understood.

Some people habitually ignore newspaper ads - or go to the refrigerator during TV commercials. Sales organizations may have little stake in facilitating consumer access to information that is not directly helpful in boosting their products.

By regulation, auto manufacturers must furnish braking, passing distance, and tire load capacity information to buyers and prospective purchasers. This information must be available to take from dealer's showrooms. Without exception, manufacturers do not combine this with their full-color brochures, but present it in a separate, plain brochure filled with data for different models and different optional equipment. An example is shown on the left of Figure 2-11. Neither industry nor government is happy with this outcome, and there appear to be few buyers who have found this brochure, and fewer still who found it understandable and useful.

In contrast, the brochure on the right of Figure 2-11 has received wide readership with good reader comprehension. Cars of many makes are compared and the meaning of the test results is explained in simple terms. Dealers whose cars do well often have these brochures prominently displayed in their showrooms.

Unfortunately, as demonstrated in Figure 2-12, some consumer education literature and displays, although colorful and potentially informative, are so complex that most consumers are not likely to take the trouble to understand them.

Ford Division

1975 CONSUMER INFORMATION

FORD
TORINO
ELITE
MUSTANG II
GRANADA
MAVERICK
PINTO
THUNDERBIRD

YC 734 Rev. 3/75

September 1974

fuel economy test results for automobiles

1975 gas mileage guide for new car buyers

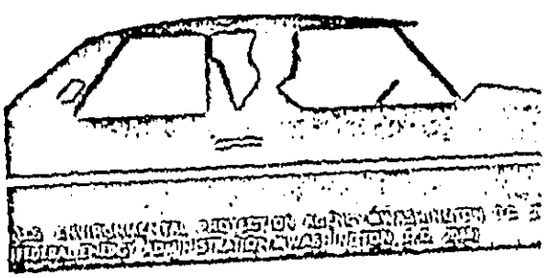


Figure 2-11 Auto Brochures

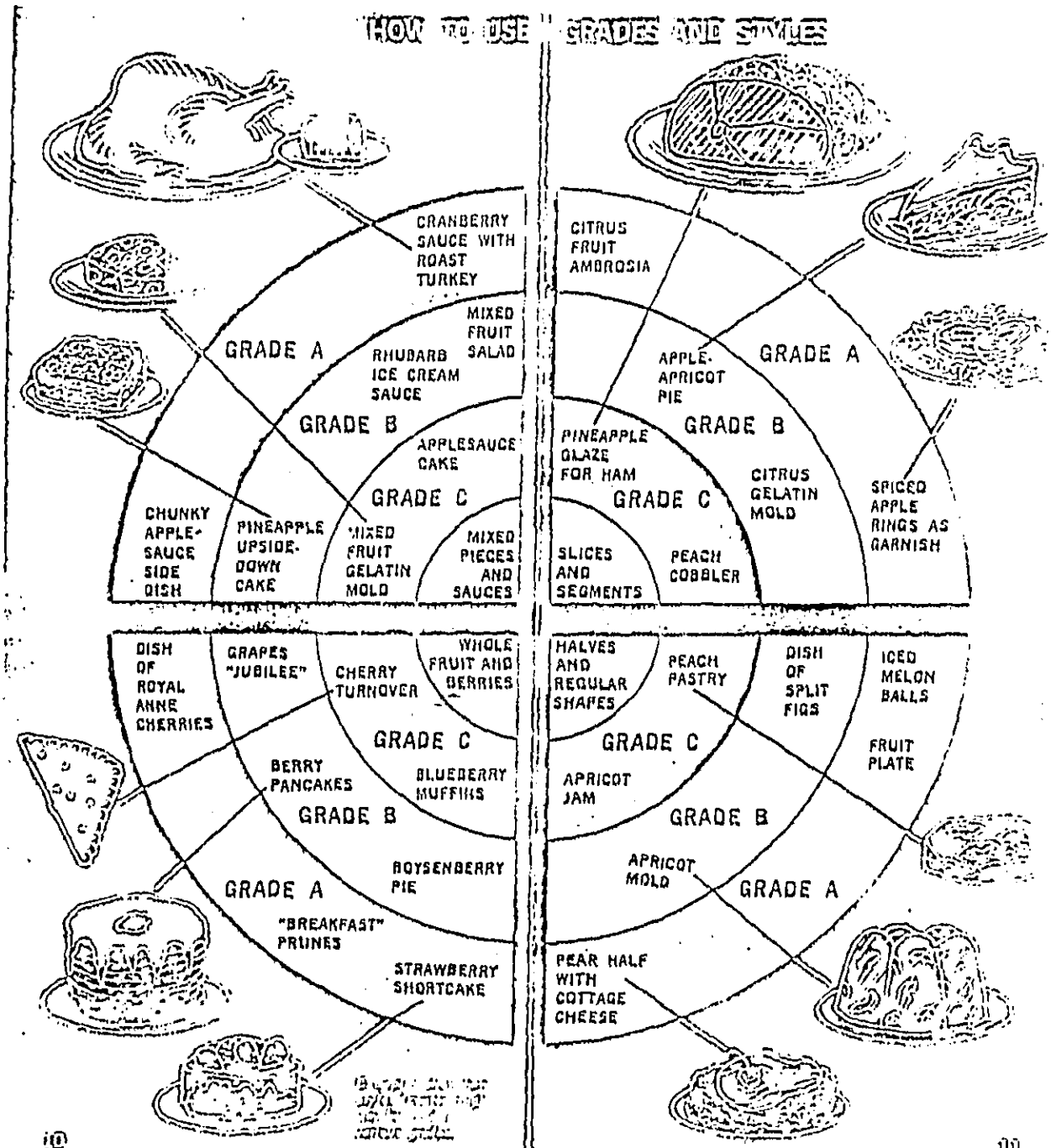


Figure 2-12 Complexity in Consumer Display

Table 2-13

Requirements for Additional Instructions

ALSO SPECIFIED BY REGULATION:

REQUIREMENTS FOR ADDITIONAL INSTRUCTIONS. THESE CAN COVER USE, REPAIR, CONSUMER EDUCATION ABOUT RATING.

- USE OF PRODUCT
- REPAIR AND MAINTENANCE OF PRODUCT
- CONSUMER EDUCATION ABOUT THE RATING
- FURTHER TECHNICAL INFORMATION

THIS WOULD NOT BE PART OF THE PRIMARY DISPLAY

Table 2-14

Physical Characteristics of a Label

PHYSICAL CHARACTERISTICS OF A LABEL:

- LABEL MATERIAL
- METHOD OF ATTACHMENT
- SHAPE AND BORDER
- LETTERING AND SIZE
- COLOR AND FINISH

The educational purpose here is largely lost. This explanation of USDA grading of fruit is almost incomprehensible at first. Even after the small footnote at lower left is found, the diagram is still unclear.

Considerable effort and testing will be necessary to ensure that an explanation of noise ratings can communicate to a non-technical audience.

The physical characteristics of a label are listed in Table 2-14. As mentioned previously, the physical characteristics of the label greatly affect its overall utility.

The discussion to follow will present more about label design, and making proper use of these characteristics.

Regulation development must consider the need to specify physical characteristics, in order to ensure both readability and permanance when exposed to the use environment.

LABEL LOCATION

In addition to the physical characteristics of a label, one needs to consider where it should be placed. There exists a number of alterntives (Table 2-15), all with a number of advantages and disadvantages, depending in part on the type and size of product, and how it is advertised, bought and sold.

The location for the primary label and for the additional information required by regulation will have to be considered for each product or product category. In most cases, more than one of the locations listed will have to be used.

Table 2-15

Location of Labels

LOCATION OF LABELS

1. FRONT OF PACKAGE
2. HANG TAG ON UNPACKAGED PRODUCT
3. DISPLAY AT RETAIL
4. PRODUCT
5. PACKAGE STUFFER
6. HANDOUTS
7. ADVERTISING
8. OTHER

RATING SCHEMES

Mentioned earlier was the necessity of reducing the results of whatever valid technical test is chosen - on the basis of its relationship to the informational needs and the accuracy and repeatability of the procedure - to an easy to understand rating. This process, presented in Figure 2-13, is part of many ratings for familiar products, for example, butter grades or tire mileage. Although this is usually thought of as a single, and perhaps simple, process called grading, it is not.

We start with a measure derived from a particular test; this test might yield a purely physical measure with results in physical quantities like miles, decibels, or % butterfat. The technical basis might be a physiological or psychological

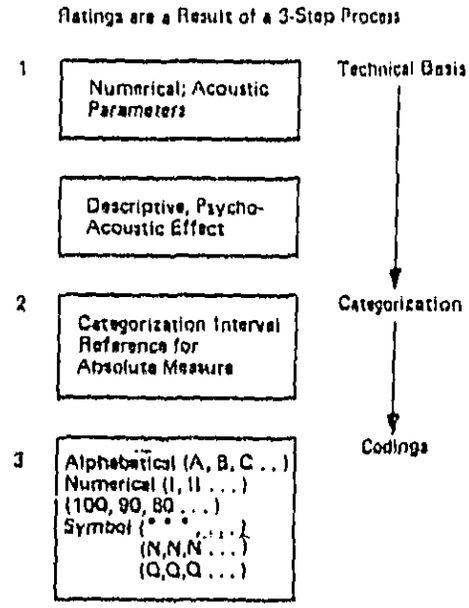


Figure 2-13. Rating Process

effect, with results like the dose for a 50% lethal effect, articulation index of X%, or the fraction of the population that would get a given amount of hearing damage. In each case the result is a number on a continuous scale. Not all different values that can be measured are significant, so the next step is to divide this continuous scale into intervals that imply significant and noticable differences. For tire mileage, this might be 1,000 to 3,000 miles; for ratings of noise producers, this might be 3 or 5 decibels.

Up to this point the rating has retained whatever measurement units are inherent in the technical basis (miles, decibels of equivalent sound level, etc.). This absolute measure can be avoided by use of an established reference point, such as 30,000 miles for tire life. Thus a 15,000 mile tire would become 50 (%) and a 45,000 mile tire would be graded 150 (%). The reader would see that 150 meant three times the life of the 50 grade, and the manufacturer would not be making a statement that implied a specific tread life under all conditions of use. Finally, one may assign codes to the various categories, although this process is fraught with considerable difficulties. Is a 90 better than a 60, if this is a quietness rating? If an A is assigned to the best product today, what is done when a better one is invented five years from now?

Table 2-16 presents a summary of a possible scheme for rating noise producers in a variety of environments.

Simple numerical coding is used, to make comparisons easy.

Qualitative explanations of these numerical values are shown, to make these values meaningful to the lay consumer.

Table 2-16

Example of Explanatory Part of Noise Label

NOISE RATING	EFFECT
115 AND ABOVE	USE OF STANDARD HEARING PROTECTION INADEQUATE TO PROTECT HEARING OF OPERATOR
110-115	DAMAGING TO HEARING OF PERSONS EXPOSED TO NOISE WHO ARE IN THE SAME (TYPICAL) ROOM OR WITHIN 450 FEET OF THE DEVICE OUTDOORS
85-100	SAME EXCEPT 100 FEET
70-85	SAME EXCEPT 25 FEET
60-70	INTERFERES WITH NORMAL CONVERSATION OUTDOORS WHEN DEVICE IS WITHIN 4 FEET AND INDOORS WHEN DEVICE IS IN ADJACENT ROOM
50-60	INTERFERES WITH NORMAL CONVERSATION INDOORS WHEN DEVICE IS WITHIN SAME (TYPICAL) ROOM
50 AND BELOW	(See note below)

Note: Determination necessary as to the capability of products to adversely effect public health or welfare.

SECTION 3

NOISE LABELING - GRAPHICS

The following discussion contains a set of solutions, illustrated in Figures 3-1, 3-2, and 3-3, to the problem of designing a label system which will alert and inform purchasers about the characteristics of noise generators and noise attenuators. It is an attempt to present the types of considerations necessary in the development of the graphical requirements associated with product noise labeling.

The primary objective in such development is to take the concepts of noise rating discussed above, and to develop the graphics for a labeling system which would be easily seen, identified, and comprehended.

BACKGROUND

We are entering an era of environmental and safety labeling. Some labels warn us of hazards, from the familiar radiation symbol and skull and crossbones to the less ostentatious and generally ignored Surgeon General's statement on a package of cigarettes.

Other relatively familiar labels inform us -- the various shields of the department of Agriculture, for example, are intended to guide the consumer when purchasing meats, cheeses, vegetables and other foods.

Some labels are new and complex, providing the public with much needed information about things like emission controls, gasoline consumption, tire safety and energy consumption.

All of these labels, as well as other useful information which may appear on products or packages, must compete with

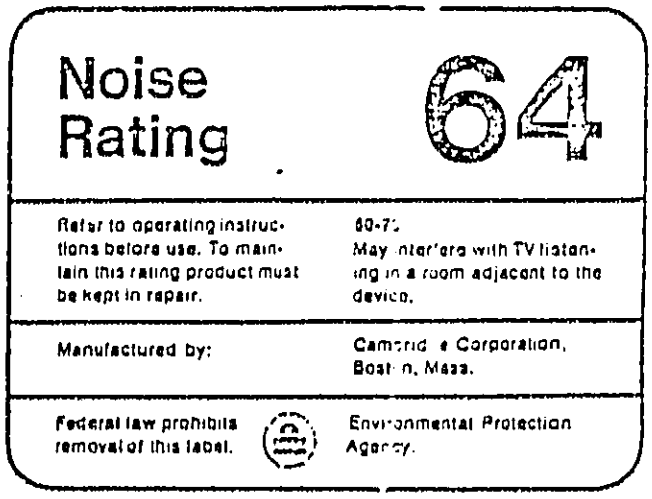


Figure 3-1. Noise Rating Label

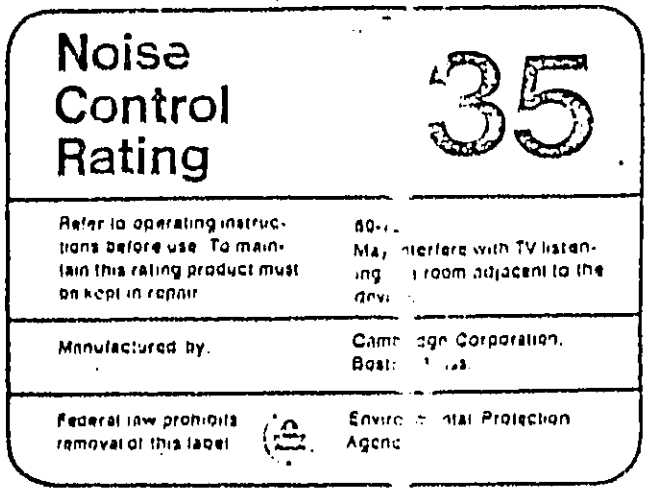


Figure 3-2. Noise Control Rating Label

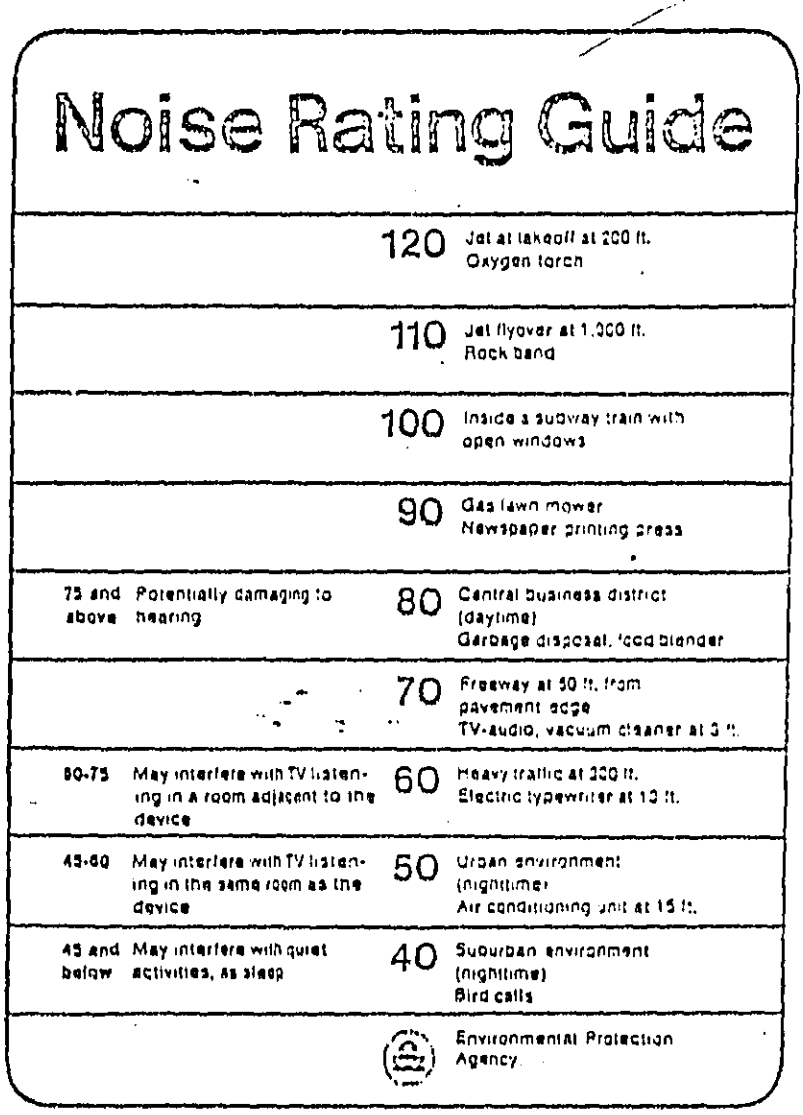


Figure 3-3. Noise Rating Guide

expensive, extensively researched, and well-designed graphics, and with the whole mass of visual information which bombards us all every day.

DESIGN CRITERIA

The first problem then, was to design a label system which would stand out, overcoming visual competition. This problem was particularly difficult in the face of the amount of information and graphics now on packages, and in consideration of the difficulties that would be faced in causing packagers to significantly alter their designs. The system, therefore, should be realistic and practical.

The next problem to be considered was the amount of information which would have to be displayed on the labels.

To begin with, the noise labels would actually serve two separate but related functions. For noise generating devices, they would have to announce a "noise rating". For noise attenuators, a "noise control rate" must be presented. It was felt that both these functions should be accommodated in a single graphic system.

As a side issue, but nevertheless an important one, was the question of whether members of the general public needed more information than sophisticated commercial buyers. The conclusion was that although many purchasing agents or plant safety managers might have a better understanding of noise problems than the average shopper, one could not make general assumptions. It was concluded that the labeling system should assume almost total ignorance on the part of every purchaser.

CONTENT

With that in mind, work began to determine the specific content with which the label system would have to deal.

The first piece of information would have to announce whether the label was dealing with noise generation or attenuation.

Next would have to be displayed the specific rating for the item in question.

The question of what kind of rating system to use was, of course, very important. Let us assume that one can use numerical ratings, ranging from 40 to 120, for noise generators, and 0 to 40 for noise attenuators. The numbers could be clearly displayed, and with the proper explanation, would provide an effective system.

The explanation would have to include the numbers used in the system, and a reference to the meaning of each which could be understood by the layman. Thus for example, there might be test which explains that "90 is the level of sound of a gas lawnmower" or "100 is the level of sound inside a subway train". It may be true that many people have never been inside a subway train; however, they are able to recognize that such a sound is loud.

Including the rating explanation may not be a problem on large packages, or with large devices, but it is a very real problem with medium size and smaller devices and packages. (For example, there are attenuators which are basically ear plugs, packaged in containers befitting their size.) Accepting the fact that 6 point type -- which is 1/12 of inch high -- is about the smallest readable type, it would be impossible to get all the information we have described on very small packages.

As a result it was decided to include only a statement of the effect of the rating appearing on the label and make reference to a complete "Noise Rating Guide", that would be included elsewhere in the system.

There were several other items which would be required on the basic label surface.

There would have to be a reference to the instruction sheet or manual that came with the item, explaining that the rating assigned to the item was based on it being in proper operating condition, as expressed in the instruction material.

Since the rating would be certified by the manufacturer, the name and the location of the manufacturing plant should also be listed.

In addition, of course, there would have to be an EPA Identification, and a statement prohibiting removal of the label before sale.

DESIGN CHARACTERISTICS

The first design characteristic to consider was shape -- The information would have to be presented on some kind of visual field. The shield, for example, is commonly used to project an image of "official" communication. The problem is, however, that because the shield is so over-used, it has lost much of its effectiveness as a distinctive form. Stars or other odd shapes come to mind as the kinds of visual formats which might attract attention. Such shapes are very inefficient for containing information with the useable area being only a portion of the total area occupied by the shape.

In line with this, the label would have to be visually separated from the product or package. It would have to

have a high degree of contrast so that it would be easily seen, and not be confused with the advertising messages and other information on packages.

The size of the label, therefore, had to be relevant to both the information to be presented, and to the product or package on which it would appear.

Placement was another consideration. The design would not only have to deal with the labels themselves, but would also have to specify the location of labeling on the package or product to insure that it would be seen immediately.

Next, there was the matter of color. Color can be an effective communications tool if used properly. It can help to establish contrast and visibility, and in certain applications, to communicate in itself. A red traffic light, for example, communicates mainly through color, and is very effective.

Typography is an important factor in any design, but it was particularly important in this situation. Whatever was done had to make use of space most effectively while communicating as clearly as possible. Type selection therefore had to be very precise.

All of these criteria, as well as the problems outlined previously, played roles in the development of the design. The designs presented are not given as ultimate solutions, but rather as design directions based on the rating and other information considered.

DESIGN DESCRIPTION

We will begin with shape.

In many ways, we live in a rectangular world. The rectangle is the most efficient shape there is in terms

of information handling. It can accommodate the maximum amount of type in the minimum amount of space.

To add a slight note of distinctiveness, to save frayed corners, and to make handling easier, corners were rounded off.

To emphasize the shape and make the entire label a more self-contained image, a narrow border around the label was added.

The next step was to start placing the information on the field that had been created.

In designing the heading for the label, the question which had to be answered was "how do you most effectively call attention to the purpose of the label?" Instead of using gimmicks of any kind, the answer is to announce the label's purpose as clearly and simply as possible.

Thus, it was decided to settle on the terms "Noise rating" and, for the attenuators, "Noise Control Rating." The terms were in an extremely clear typeface called Helvetica.

It is a very contemporary sans-serif typestyle which has come to be accepted as a standard of clarity around the world.

The next major piece of information -- perhaps the most important on the entire label -- is the rating itself. This would be displayed in very large type -- again using the same clear and easy to read typeface.

Continuing with the design of the label, rules were used to separate the different informational elements. These rules add to the boldness of the overall image and, at the same time, alert the reader to the fact that there are separate messages to be read.

After the rating number, there appears a brief statement explaining the meaning of the rating appearing on the label. The reference to the operating instructions would be the next piece of information.

The same standard typeface would be used to identify the manufacturer and his location and could include a product number. It is felt that there should be no trademarks here, since they would only add visual clutter to the label and create design problems. The label should not be looked on as an advertising medium in any way.

The present EPA symbol would be used along with the agency's identification. It should be noted that the use of the symbol is not included as a major component of the label because it is felt that it might be misleading: Although it may be very pertinent to the natural environment, it does not necessarily telegraph anything relating to noise, or noise control and could therefore distract the reader from the principal message.

Again using the standard typeface, the prohibition not to remove the label prior to purchase would be placed near the EPA Identification to add to the authority of the prohibition.

NOISE RATING GUIDE

The explanation of the rating system would appear in a separate "Noise Rating Guide" which could be required as a separate sheet packed with the product, or as an inclusion in the instruction manual. It would have a standard format. The various numbers would be prominently displayed, and their meanings and effects would be closely related to them, so that there would be no confusion as to what explanations related to what numbers. Copies of the noise rating guide could be required at all points of sale.

LABEL USES

The label could be used in two ways: on the package and on the product. It can be a hangtag where necessary.

It could always appear in either white with black or black with white type, depending on which format provided the highest measure of contrast with the basic package.

For noise generators which produce uncomfortably or dangerously high levels of noise, the label could be required in red and white instead of black and white.

PLACEMENT

On packages, the noise rating label would have to appear on the main display panel or panels.

To help make sure that the label is not lost on the panel, it could be required that it be lined up with at least one edge of the panel and that there be a distance of no less than 1/8th of the label's height between the label and the edge of the panel.

Specifications on the size of the label with regard to the overall panel size, should also be provided.

EDUCATION

The system's ultimate success, as would be true of any design, would depend in great measure on the educational materials and publicity which surround its introduction and use.

Through posters, folders, advertisements, TV commercials and other public awareness programs, the public could be alerted to the need for noise ratings and to the benefits that can accrue from such a program.

A good deal of effort may be required in explaining what the noise rating means, and to how the public should translate these ratings for their own use.

Noise regulation and ratings are new concepts to most people, and the noise rating system will be new to almost everyone. It is thus critical that the public education program be properly conceived and executed.

SECTION 4

RATING SCHEMES FOR NOISE PRODUCERS

Certain restraints limit the range of choice for a rating scheme to be used in connection with the EPA noise labeling program. Some of these restraints are determined by the acoustical nature of the kinds of equipment likely to be labeled; others may depend on the noise ratings already selected by other groups, such as the national or international standards organizations or equipment manufacturers' associations.

There may be good reasons for EPA to depart from the practices adopted or drafted by these other groups; but, if so, the departure should be a matter of informed deliberation and the reasons should be explicit and fully understood.

Subsection 2 of this section considers the nature of the noise sources likely to come under the labeling regulations; Subsection 3 discusses how sound behaves in different kinds of space according to accepted textbook acoustical theory. Subsection 4 discusses typical user distances and label-noise-rating categories. Subsection 5, which concludes this report, considers some possibilities for a rating scheme but warns that no irrevocable action should be undertaken without further investigation of how the acoustics of real room in dwellings conform to the textbook theory on which the conclusions of this report are based.

CHARACTERISTICS OF EQUIPMENT LIKELY TO BE LABELED

We begin by looking at the typical noise spectra of the kinds of equipment that are likely to be labeled. In

particular, we are interested in *which* octave bands of frequency for each type of equipment dominate the A-weighted sound level. We next consider the acoustical characteristics of the kind of space in which the equipment is typically used, whether outdoors or indoors, and if indoors, whether it is an acoustically "live" room or "dead" room.

It turns out that these matters have a strong bearing both on the selection of a noise rating scheme for labeling equipment and on the procedure for measuring equipment noise.

In a recent report to EPA evaluating various alternative strategies for noise abatement [1], a number of appliances and items of household equipment were assessed in terms of the noise exposure for people who use the equipment (primary exposure) and for others in nearby areas (secondary exposure). According to the effective $L_{eq(24)}$ for the appliance as it affects the average exposed person, certain items were identified as major noise sources, as candidates for labeling, or as requiring no action at all.

Candidates for labeling [from Table 5 of Ref. 1] are listed in Table 4-1 together with the octave band of frequency that dominates the A-weighted sound level, the kind of space in which the appliance is generally used, and the type of acoustical radiation that dominates the noise of the device.

It can be seen that, partly because there is strong discrimination against low frequencies in the A-weighting but also because the noise of many of these appliances is intrinsically strong in the high frequencies, the A-weighted sound levels for these appliances are determined largely by frequencies of 500 Hz or higher. The appliances are about equally divided according to the kind of space in which they

Table 4-1. NOISE CHARACTERISTICS OF INDOOR HOUSEHOLD EQUIPMENT

Equipment	Dominant Octave Band in A-weighted Sound Level	Where Used*	Type of Source†
Humidifier	500 Hz	D	D
Floor Fan	500 Hz	D	Q
Dehumidifier	1000 Hz	L	D
Window Fan	500 Hz	D	Q
Air Conditioner	250-2000 Hz	D	D
Toilet	1000 Hz	L	M
Dishwasher	500 Hz	L	M
Vacuum Cleaner	2000 Hz	D	D
Food Blender	2000-4000 Hz	L	M
Electric Shaver	4000 Hz	L	M
Food Disposal	2000-4000 Hz	L	M
Home Shop Tools	2000 Hz	L	M,D

*L = Live room (A = 30 to 70 sabines); bath, kitchen or workshop; D = Dead room (A = 100 to 400 sabines); living room or bedrooms.

†M = monopole (or simple) source; D = dipole, Q = quadrupole.

Note: The octave-band noise spectra for average examples of these appliances [2] are given in Appendix A, along with the same spectra to which the A-weighting has been applied, in order to show which octave band dominates the A-level.

are typically used, and no one kind of acoustical radiation is in the majority; all must be considered. (Monopole sources tend to behave one way; dipoles and quadrupoles, another.)

HOW SOUND BEHAVES

SOUND POWER LEVEL VS SOUND PRESSURE LEVEL

Two basic properties of the noise from a source have been proposed for use in rating schemes: sound *power* level and sound *pressure* level. Since the use of each has advantages and disadvantages, the acoustic community is sharply divided as to which is most appropriate for product labeling.

The advantage of sound power level as a noise rating for a source, according to the "sound power" proponents, is that it is fixed and unchangeable. It is said that, if the sound *power* level for an appliance is known, the sound *pressure* level at any location can be calculated without much difficulty. We shall see that this "fixed and unchangeable" claim is valid only under certain limited conditions.

The disadvantage of sound power level as a noise rating is that the human ear does not respond to sound power, but to sound pressure. It is possible, for example, to make up a table of the effects of noise on people in terms of sound pressure (or sound pressure level), but not in terms of sound power. The reason is that, although the sound power of a source may be constant, the effect of the noise on people depends on how close they are to the source.* Near

*Similarly, although the wattage of a light bulb may be fixed, the brightness (which our eyes respond to) is greater close to the bulb than far away.

the source, the sound pressure is high and the effect of the noise may be severe; far from the source the sound pressure is lower and the effects are much less; in fact, at great distances the sound will not be audible at all.

The great advantage of sound pressure for rating purposes is the direct relation this quantity bears to the human effects of the noise. The disadvantage is that it is not a fixed quantity; it depends on circumstances. One manufacturer may rate his product in terms of the sound pressure level at a distance of 3 ft, for example, and another manufacturer might label his equally noisy product with the sound pressure level at 4 ft and claim a better noise rating.

A possible solution would be to report the sound pressure level at a *standard* reference distance from the source, preferably a typical user distance. The selection of a typical user distance for different kinds of equipment, however, is currently a matter of considerable dispute among noise standards groups. The various arguments that figure in this dispute are the background against which the choice of a rating scheme for labeling must be made.

Unfortunately, without a certain amount of technical understanding about the behavior of sound sources, seriously wrong choices might be made. The following discussion tries to present the essential points as clearly and simply as possible; as far as we know, such a discussion has not appeared elsewhere, so it is no wonder that standards writing bodies have lacked guidance.

RELATION BETWEEN SOUND POWER AND SOUND PRESSURE IN VARIOUS SITUATIONS

Sound Outdoors

Sound power refers to the rate of generating acoustic energy - i.e., the total amount of acoustical energy radiated by the source per second. It is measured in watts. Sound power *level* (L_W) is the same quantity expressed in decibels* (dB) with respect to the standard reference power of 10^{-12} watts.

$$L_W = 10 \log_{10} \frac{W}{W_0} = 10 \log_{10} \frac{W}{10^{-12}} = 10 \log_{10} W + 120 \quad (4\text{-}1)$$

where W is the sound power of a source in watts, and L_W is the corresponding sound power level in dB re 10^{-12} watts. Doubling the sound power increases both the sound power level and the sound pressure level by 3 dB (see below).

The sound power accounts for all the sound energy leaving the source in all directions. If we imagine the source as suspended in free space, the same amount of sound power would pass through a 1-ft (imaginary) sphere surrounding the source as through a 10-ft sphere. The power per unit area, however, would be less for the larger sphere because the same amount of sound energy is "spread thinner" over the greater surface area of the larger sphere. The larger the sphere (i.e., the farther away from the source), the thinner the total energy must be spread. This process

*The decibel scale is a logarithmic scale that compresses the enormous range of sound power and sound pressure values that occur in the environment into a more conveniently manageable range. The reference quantity should always be stated to avoid misunderstanding.

accounts for the decrease of sound *pressure* (which is what the ear responds to) with increasing distance from the sound source. Sound pressure is measured as a force per unit area, usually in newtons per square meter (N/sq m). Sound pressure *level* is the same quantity expressed in dB but referenced to the standard quantity of 20 μN/sq m:

$$L_p = 10 \log_{10} \frac{p^2}{p_o^2} = 10 \log_{10} \frac{p^2}{20^2} = 20 \log_{10} p - 26, \quad (4\text{-}2)$$

where p is the sound pressure at a certain location in μN/sq m and L_p is the corresponding sound pressure level in dB re 20 μN/sq m. Doubling the sound pressure increases both the sound power level and the sound pressure level by 6 dB.

Sound Source Out in Space

In free space (for practical purposes this means outdoors, away from reflecting surfaces), sound pressure level and sound power level are related [3] as shown by Curve A of Figure 4-1. This line corresponds to the equation

$$p^2_{(r)} = (Wz) \frac{Q}{4\pi r^2}, \quad (4\text{-}3)$$

where W is the sound power of the source in watts, z is a quantity called the characteristic acoustic impedance of the air (400), Q represents the directivity of the source (1 for a point source, 3 for a dipole in the axial direction), and r is the distance in feet from the center of the sound source (assumed to be small, essentially a point). The decibel equivalent of Eq. 4-3 is

$$L_p = L_W + 10 \log_{10} \frac{Q}{4\pi r^2} + 10, \quad (4\text{-}4)$$

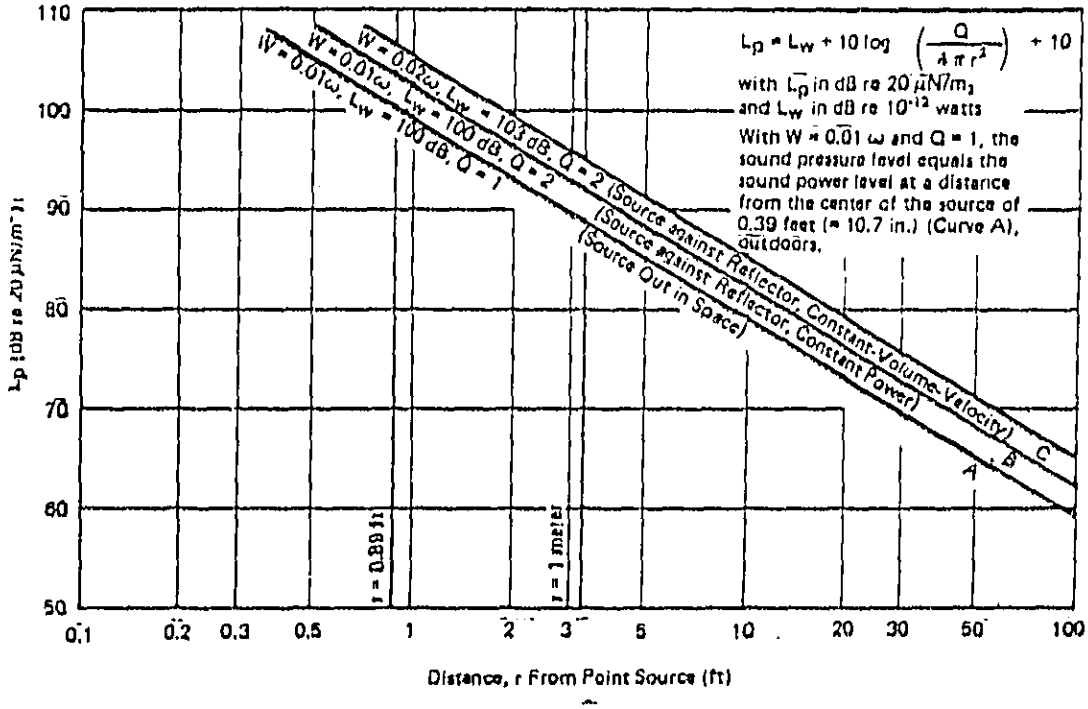


Figure 4-1. Behavior of Sound Outdoors

with L_p the sound pressure level in dB re 20 $\mu N/m^2$ and L_W the sound power level in dB re 10^{-12} watts. The sound source is assumed to produce a sound power of 0.01 watts, corresponding (see Eq. 4-1) to a sound power level of 100 dB re 10^{-12} watts. Note that the sound pressure level decreases at the rate of 6 dB for each doubling of distance from the center of the source.

Sound Source Against a Reflecting Surface

Suppose the source were resting on the hard ground (or against any reflecting surface), instead of up in the air, and were still radiating an amount of sound energy W = 0.01

watts. The radiated energy would be spread over only a hemisphere, instead of an entire sphere. This change in directivity of the source increases the value of Q to 2 and doubles the value of p^2 (Eq. 4-3), corresponding to a 3-dB increase in sound pressure level (Eq. 4-4). This behavior is shown by Curve B in Figure 4-1. The sound pressure level again drops off at 6 dB per doubling of distance.

In fact, however, the sound energy radiated by real sound sources *is actually changed* by the presence of a nearby reflecting surface, such as the ground [4,5]. Many real-life sources behave like "constant volume-velocity sources" (meaning that the motion of the vibrating surface of the equipment is unaffected by the surroundings); for such sources, the sound power is doubled when the source is moved directly against a large, rigid reflecting surface. In this case, the source and its reflected image exactly coincide and the energy of the source is added to the energy of its reflected image, exactly in phase, so the sound power is 0.02 watts. Therefore, in addition to the 3-dB increase in sound pressure level due to the changed directivity of the source when placed against the ground, there is another 3-dB increase, because the presence of the ground doubles the power output. This behavior is shown by Curve C in Figure 4-1; L_p in this case is 6 dB higher at all distances than with the source "out in space".*

*An even greater change, both in source directivity (+6 dB) and power output (+6 dB), occurs when the source is moved into the right-angle corner between the ground and a large wall, and still a greater change (+9 dB in both cases), if it is moved into a trihedral corner (right-angle intersection of three planes). Here, we confine our discussion to a single plane reflecting surface.

If the source were moved away from the reflecting surface, the source and its image would not coincide and their two energy components would combine less effectively, with a time lag. When the source is more than about a wavelength away, the reflecting surface has little effect on the radiated power.

Other types of sound sources (some kinds of fans, for example), react to the presence of a nearby reflecting surface with a *decrease* of output [6]; this change could effectively cancel the increase due to changed directivity.

In general, then, it is clear that the sound power level is *not* "fixed and unchangeable".

Sound Indoors

Sound Source Out in Space

Sound from a source out in the center of a room behaves, in the region very close to the source, just as it behaves outdoors. The room boundaries are so far away that they do not influence the local sound behavior. As the observation points moves away from the source, the sound pressure level decreases, just as it does outdoors, at 6 dB per doubling of distance.

Indoors, however, the sound energy from the source is confined by the boundaries of the room; if there were no sound absorptive material at all in the room, the sound energy would continue to accumulate indefinitely, leading to higher and higher sound pressure levels. In fact, however, some sound absorption is always present, and the sound pressure builds up only to the point where as much energy is being lost to the sound absorptive room boundaries as is

being supplied by the source. The more sound absorption in the room, the lower the built-up sound pressure level.

The behavior of sound indoors, thus, is different in each of two regions. Near the source (the so-called "direct field"), the behavior is like outdoors; the sound pressure level is determined by the sound power of the source, the directionality of the source, and the distance of the observer from the source. The sound pressure level decreases with increasing distance from the source (at 6 dB per distance doubled), until it equals the level of the built-up sound confined in the room. Beyond that "equal-point", the sound pressure level is no longer determined by the direct field, which continues to decrease with increasing distance.

Instead, in the region beyond the equal-point (the so-called "reverberant field"), the sound pressure level is more or less the same everywhere; it is due to the accumulated confined energy and is determined only by the sound power of the source and the amount of sound absorptive material in the room, not by the distance from the source or the directivity of the source.

This two-region behavior is illustrated in Figure 4-2 for three rooms containing different amounts of sound absorption.* The upper curve corresponds to a very "live" room, containing only 30 sabines (typical of a bathroom where the sound absorption might be 25 to 45 sabines). The second curve is for a room with 70 sabines (typical of

*Sound absorption is measured in sabines: the symbol is A. One sabin is roughly equivalent to 1 sq ft of open window through which incident sound is assumed to pass and be lost to the room. A 4-sq ft patch of material that absorbs just half the incident sound energy is said to have a sound absorption coefficient of 0.5 and to contribute 2 sabines of sound absorption to the room.

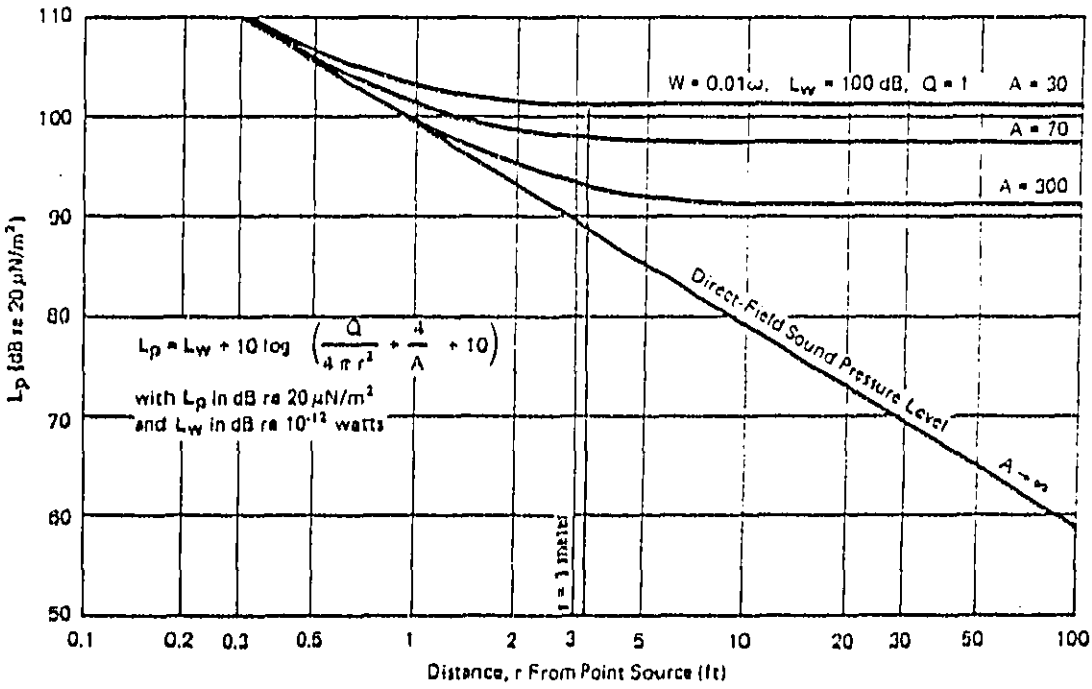


Figure 4-2. Behavior of Sound Indoors, Sound Source Out in Space

a kitchen where sound absorption ranges from about 50 to 75 sabines). The third curve is for a living room with 300 sabines. (Living rooms and bedrooms, which are usually more heavily furnished with absorptive furniture and materials than other rooms, are rather "dead", acoustically; typical absorptions range from 180 to 500 sabines.) The lowest curve represents the level of direct-field outdoor sound, which is masked by the reverberant sound at distances greater than about 5 ft.

The curves of Fig. 4-2 correspond to the equation

$$P^2_{(r)} = Wz\left(\frac{Q}{4\pi r^2} + \frac{4}{A}\right). \qquad (4\text{-}5)$$

The first term is the direct sound, already encountered in Eq. 3 in the discussion of sound behavior outdoors; the second term accounts for the reverberant sound in the room. If the absorption in the room is very great, the second term tends to zero, and the sound behaves as if it is outdoors; if the distance from the source is very great, the first term tends to zero and the reverberant sound dominates. The decibel equivalent of Eq. 4-4 is

$$L_p = L_W + 10 \log\left[\frac{Q}{4\pi r^2} + \frac{4}{A}\right] + 10 \ . \qquad (4\text{-}6)$$

Note also that the boundary between the regions of the direct and the reverberant sound fields, where the curve levels off, lies somewhat nearer the source for a live room than for a dead room; when there is lots of sound absorption in a room, the "outdoor behavior" persists to greater distances.*

*Acoustics textbooks sometimes point out the fact that in real rooms the sound level is not always so uniform as is indicated by the horizontal portions of the curves at the right of Fig. 2 (and 3). Indeed, it is true that for narrowband sources there will be fluctuations of sound level (up to +5 dB) for pure tones) *around those curves as averages* in the reverberant sound field. However, for broadband noise spectra, for which the use of A-weighted sound levels is appropriate, such fluctuations are negligible. If pure tones, which would tend to increase the spatial fluctuation of the sound level, are present, they would also disqualify the use of the A-weighted sound level for rating the noise.

Sound Source Mounted in Hole in Wall

Suppose now that the sound source (for example, a window fan) is mounted in a hole in the wall, so that it radiates half its energy outdoors and half indoors; in this case, there is no reflected image of the source.

Viewed from outdoors, the effective sound power is half the original total sound power: $W = 0.005$ watts, $L_W = 97$ dB. Because this energy is radiated into only half a hemisphere, the directivity is doubled ($Q = 2$), as when the source was resting on the ground in the example above; but halving the sound energy corresponds to a *decrease* of 3 dB. The net result is that the sound outside the building behaves just as in free space, according to Curve A of Fig. 4-1; the presence of the building makes no difference.

Inside the room, the sound power is also 0.005 watts, and $Q = 2$, so the *direct* field sound pressure level will be the same as outdoors (Curve A of Fig. 1) and also the same as the lowest curve of Fig. 4-2. However, halving the energy radiated into the room decreases the *reverberant* sound pressure levels by 3 dB; doubling the directivity does not compensate for this decrease, because the directivity of the source has no effect on the reverberant sound pressure level off at values 3 dB below the values shown in Fig. 4-2.

Constant-Volume-Velocity Sound Source on the Wall or Floor

If, instead of being mounted in a hole in the wall, the source is entirely within the room and against a hard room boundary, the radiation is once more into a hemisphere, so $Q = 2$; but now the source again coincides with its reflected image, and the sound power is doubled: $W = 0.02$ watts and $L_W = 103$ dB.

The *direct* sound field (indoors or outdoors) behaves according to Curve C of Fig. 4-1; it lies 6 dB above the curve for "source out in space" at all distances.

The curves in Fig. 4-2 of the *reverberant* field sound pressure level for the three rooms now lie 3 dB *higher*, because twice as much energy is being radiated into the room. This behavior for "constant-volume-velocity source against a reflector" is shown in Fig. 4-3; this figure, for the "source against a reflector", should be compared with Figure 4-2 for the "source out in space."

Again, for the two live rooms, the sound *pressure* level equals the sound *power* level within 2 1/2 dB, provided that the sound power was actually measured with the source against a reflector, so that the energy doubling is properly taken into account.

How Close is "Close"?

The discussion so far has assumed small "point" sources and the possibility that when a source is "on" a reflecting surface, it virtually lies in the surface and coincides with its reflected image. This assumption is the theoretical requirement for hemispherical directivity and energy-doubling when a source lies against a reflecting surface. Actual noise makers have finite size, however, and the effective source of the sound *cannot* be placed directly on a reflecting surface. The question thus arises as to how close such real sources must be to a reflector in order to realize the increased directionality and energy doubling discussed above.

Figure 4-4a shows the variation in sound power output for a single frequency, as sound sources of various types are moved away from a large reflecting surface. Figure 4-4b shows that the behavior is not much different for broadband noise

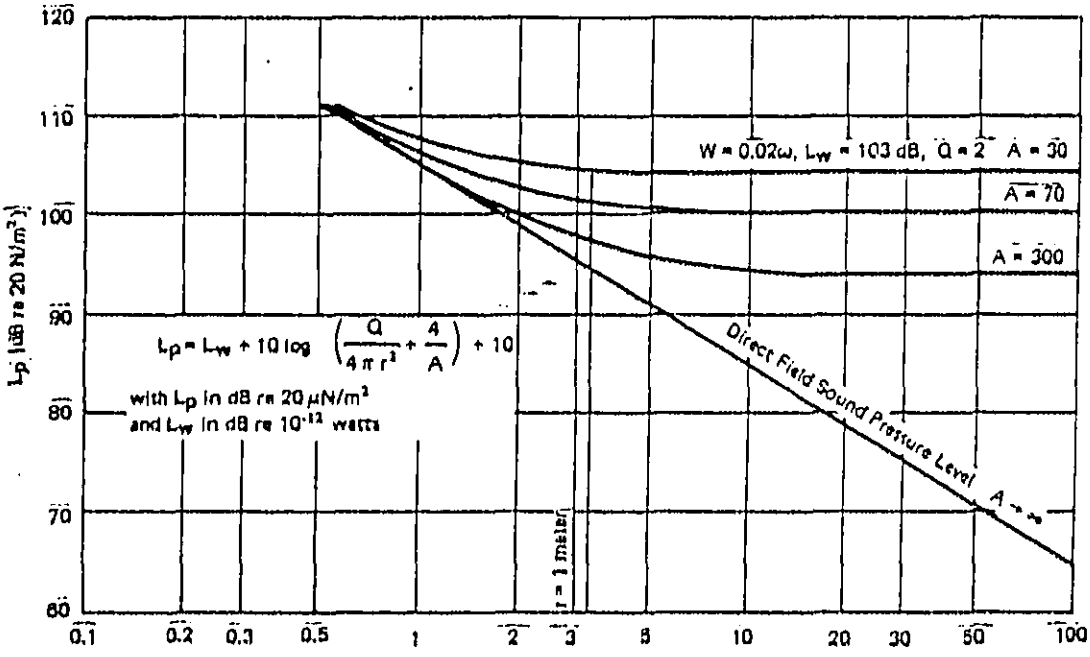


Figure 4-3. Behavior of Sound Indoors, Constant-Volume-Velocity Sound Source on Reflecting Surface

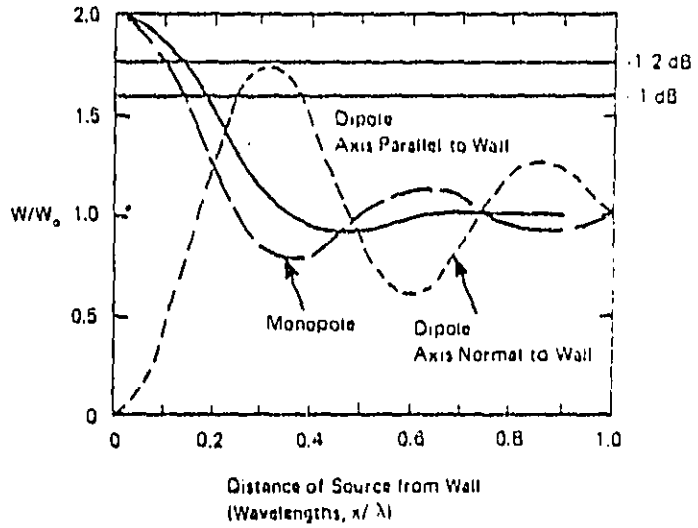


Figure 4-4a. Variation in Sound Power Outputs as Source is Moved Away From Reflecting Wall

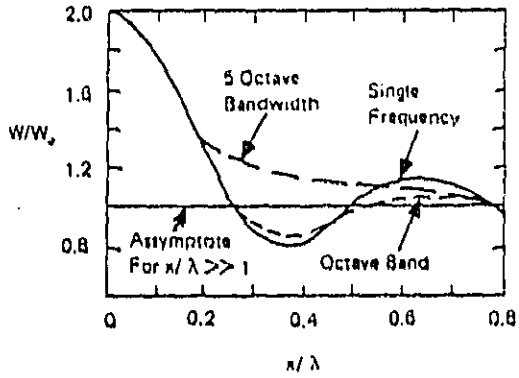


Figure 4-4b. Behavior of Sound Source Near a Reflecting Surface (Not Much Changed By Averaging Over Frequency.)

spectra. These theoretical results have been experimentally verified by measurements of the reverberant sound levels in a reverberation room. Note that the power output drops off rapidly as the source moves away from the reflector: For monopole sources, when the separation is 1/4 of a wavelength, the power is down to the "out in space" value; at about 1/3-wavelength separation, the power has fallen considerably below its normal value. When the separation exceeds a wavelength, the sound power has essentially its "out in space" value - i.e., $W/W_0 = 1$.

The levels in decibels on Fig. 4-4a refer to the sound power level relative to the value with the source directly on the reflecting surface; the reverberant sound field in the room would follow these levels, as the source is moved away from the surface. For the reverberant sound pressure level to be within 1 dB of the "source on surface" value, the source must be at a distance less than 1/5-wavelength from the surface. The direct sound field, however, is affected by both the energy output of the source and its directivity; the changes in direct-field sound pressure level would therefore be twice as great. For the direct-field sound pressure level to be within 1 dB of the "source on surface" value, the source must actually be within 1/10 of a wavelength of the surface.

Note that these observations have implications for the steady-state test method that measures the absorption in a room by comparing the nearfield sound pressure of a small source with the farfield (reverberant) sound pressure, with the distance from the source for the near measurement carefully fixed. The assumption underlying the steady-state method is that the difference between nearfield and farfield pressures depends only upon the amount of absorption in the

test room, once the method is calibrated by decay measurement of the absorption for one room's conditions.

We have just seen, however, that the direct-field and reverberant sound pressures depend in different ways upon the distance of the source from the nearest reflecting surface. Therefore, the nearfield-farfield difference, for a given room absorption, also depends on the distance of the source from the reflecting surface. Not only must the distance from the source be carefully controlled for the near measurement, but also the distance of the source from large reflecting surfaces must be kept the same as for the calibration of the method. The safest procedure would be to keep the source well "out in space", away from any room boundaries.

Returning to the kinds of equipment likely to be subject to EPA labeling, it is of interest to determine the separation from a reflecting surface corresponding to 1/10-wavelength for the octave band that governs the A-weighted sound level. Only if the effective center of the sound source of the equipment is located this close or closer to a surface will the hemispherical directivity and the energy-doubling occur. Table 4-2 gives those separation distances within which power doubling occurs (Fig. 4-3) as well as the separations beyond which the source is effectively "out in space" (Fig. 4-2). It is clear that these items of equipment will hardly ever be used in such circumstances that hemispherical directivity and energy-doubling will occur. Even in the case of vacuum cleaners (and lawn mowers) that necessarily operate against a surface, the surface is highly sound absorptive in the frequency range that governs the A-weighted sound level.

TABLE 4-2. SEPARATION DISTANCES "CLOSE" TO A REFLECTING SURFACE AND "OUT IN SPACE".

Equipment	"Close to Surface"	"Out in Space"
Humidifier	1.7	27
Floor Fan	2.7	27
Dehumidifier	1.35	13.5
Window Fan	2.7	27
Air Conditioner	0.6 to 5.4	6 to 54
Toilet	1.35	13.5
Dishwasher	2.7	27
Vacuum Cleaner	0.6	6
Food Blender	0.3 to 0.6	3 to 6
Electric Shaver	0.3	3
Food Disposal	0.3 to 0.6	3 to 6
Home Shop Tools	0.6	6

Note that for low frequencies it may be impossible for indoor sources to get far enough away from the room boundaries for the energy-boosting effect to disappear entirely. It is often found that the low-frequency sound power output of a piece of equipment is substantially different when measured outdoors (or in an anechoic room) than when measured in a reverberant room. This difference represents a true difference in sound power output, due to the reaction of the room upon the source. The difference may be positive or negative, depending on whether the source is of the "constant-volume-velocity" type (more power indoors) or "constant force" force" type (less power indoors).

At high frequencies, however, where the wavelength is small compared to the room dimensions, so long as we confine ourselves to broadband noise sources (no prominent single tones), there is no significant room reaction on the source

at distances more than a wavelength or so from the boundaries. (In other words, the acoustic impedance presented to a broadband source, in a room whose dimensions are large compared to the wavelength, is the same as outdoors, namely, ρc.)

Inherent Directivity of the Source

The discussion so far has assumed a monopole ("simple" or "point") source that radiates sound equally in all directions, so long as it is "out in space"; for such a source, the intrinsic value of Q is 1, and this value changes only when the source is near a reflector. Sound sources of higher order (dipoles or quadrupoles, for example) have an intrinsic directivity: For a given sound power, the sound pressure at the user's ear depends on the direction in which the source is pointing. (The reverberant-field sound pressure, of course, is the same as for a monopole source of the same power.*)

For such a sound source, the horizontal portions of the curves at the right of Fig. 4-2 would always be the same, as shown, but the direct-field portion of the curve would move up or down, depending on whether the beam of the source is pointed toward or away from the observation point.

In practice, therefore, this difference is of concern only for equipment for which the typical user's location is in the *direct* field - i.e., equipment that is hand-held or operator-attended. Such equipment is typically moved about

*Gösele has studied a variety of hand-held equipment and has determined that the large majority represent source types between simple monopoles and dipoles [7].

in use, so that the sound pressure at the user's ear is sometimes greater and sometimes less than the average. Thus, for noise-rating purposes, we can assume that the *effective* sound pressure, as it affects the user, is approximately the same as for a monopole source having the same power, and we can continue to use monopole curves such as those of Fig. 4-2.

General Curves Relating Sound Power Level and Sound Pressure Level

In fact, however, Fig. 4-2 itself is not a very convenient form for general use, because (in order to simplify the earlier discussion) it was plotted for a specific value of sound power level, L_W = 100 dB re 10^{-12} watts. (The same is true of Figs. 4-1 and 4-3.) Therefore, we have replotted Fig. 4-2 in *general* form in Fig. 4-5, which shows on the vertical scale the difference between the sound pressure level and the sound power level. So long as the sound power level is measured with the equipment in a location with respect to reflecting surfaces that are typical of actual use, Fig. 4-5 will give the correct sound pressure level. No assumption is needed about the effect of nearby reflecting surfaces on the relation between sound power and sound pressure, because those effects concern only the direct field of the sound source; the sources for which the user's ear will be in the direct field are not likely to be used "close" to a reflecting surface, as defined earlier.

TYPICAL USER DISTANCES AND LABEL-NOISE-RATING CATEGORIES

We return now to consider typical user distances for the various kinds of equipment likely to be labeled. Such equipment falls into three categories:

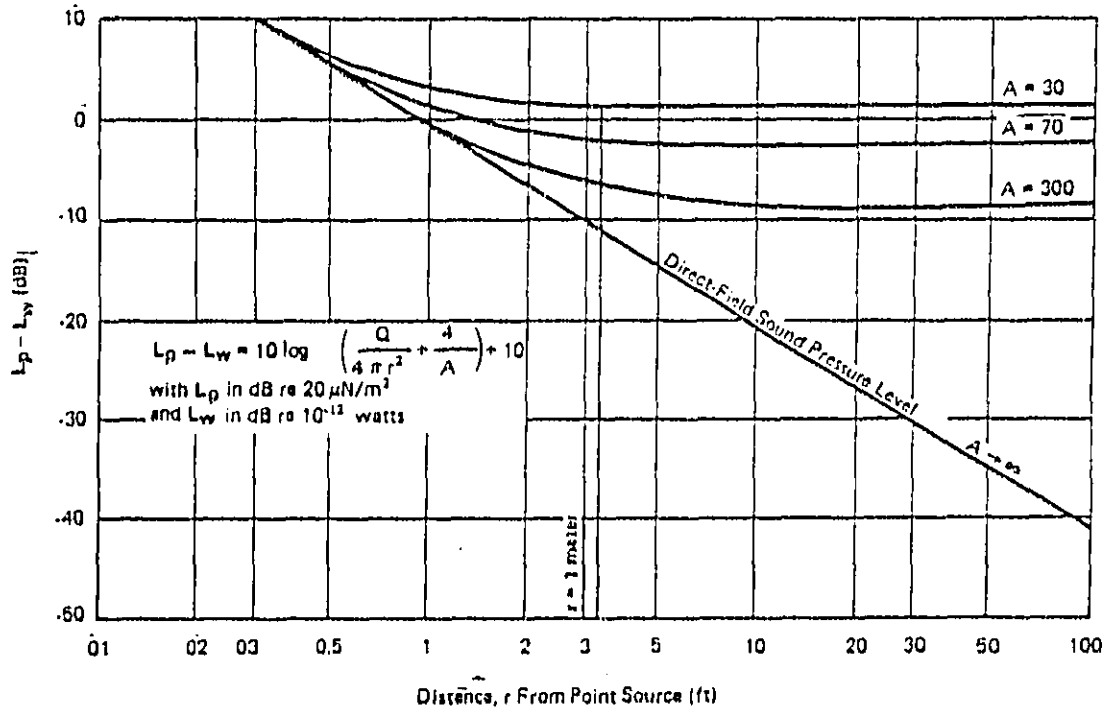


Figure 4-5. Behavior of Sound Indoors, Sound Source Out in Space: (Difference Between Sound Pressure Level and Sound Power Level.)

A. Equipment used on or about the head, such as the various electrical grooming devices;

B. User-operated tools that are hand-held or controlled within arm's length;

C. Fixed equipment that is not operator-attended.

For equipment in Category A, the user is always in the direct sound field; for Category C, the indoor user is practically always in the reverberant field, while the outdoor user is usually far enough away that the question of labeling is of little significance. For Category B, the

indoor user is in the transition region between direct and reverberant fields; but, as can be seen from Fig. 4-5, at distances from 1 ft and an arm's length, the sound pressure level at the user's ear is nearly the same as in the reverberant field.

Further inspection of Fig. 4-5 reveals that, so far as the sound pressure at the user's ear is concerned, practically all equipment falls into only two label-noise-rating categories:

1. Equipment for which the sound pressure level is about equal ($\pm$2 dB)* to the sound power level; this includes Category A and all of Categories B and C that are used in "live" rooms, such as baths and kitchens and workshops.

2. Equipment for which the sound pressure level is about 8 dB ($\pm$2 dB) lower than the sound power level/ this includes all outdoor equipment in Category B and all indoor equipment in Categories B and C that are used in "dead" roo rooms, such as livingrooms and bedrooms. (Outdoor equipment in Category C, as mentioned above, is not of interest for labeling purposes; if it were very noisy, it would be regulated rather than labeled.)

Table 4-3 indicates the typical user distance category for the kinds of equipment considered earlier and shows the label-noise-rating category that would be appropriate.

For all equipment in Label-Noise-Rating Category 1, the number that appers on the label would be the sound power level; for equipment in Category 2, the number on the label would be the sound power level minus 8 dB. The sound power level in question is the value measured with the equipment in its typical location with respect to reflecting surfaces.

*According to most noise-rating schemes, people do not discriminate noise levels in steps finer than about 5 dB.

TABLE 4-3. TYPICAL USER DISTANCE CATEGORY AND APPROPRIATE LABEL-NOISE-RATING CATEGORY

Equipment	User Distance Category*	Label-Noise-Rating Category
Humidifier	C	2
Floor Fan	C	2
Dehumidifier	C	2
Window Fan	C	1 (?)
Air Conditioner	C	2
Toilet	C	1
Dishwasher (Note 1)	C	1
Vacuum Cleaner	B	2
Food Blender (Note 2)	B	1
Electric Shaver (Note 3)	A	1
Food Disposal	B	1
Home Shop Tools	B	1

*A - equipment used on or about the head; B - operator-attended equipment, used at convenient working distance, less than an arm's length; C - equipment that is fixed and not operator-attended.

Note 1: Includes clothes washers and driers.

Note 2: Includes all other portable food preparation equipment, such as electrical mixers, slicers, grinders, etc.

Note 3: Includes all other personal grooming equipment, such as barber's clippers, hair driers and stylers, electric toothbrushes, oral lavage, etc. Possibly, electric shavers should occupy a special class, since they can be used very close to the ear, and thus, according tothe curve of Fig. 5, could impose sound pressure levels that exceed the sound power level by 5 or 6 dB.

In all cases, the number of the label represents the actual sound *pressure* level at the typical user's ear; thus, it may be used to estimate the human effect of the noise, in terms of speech interference, annoyance, etc.

CONCLUSION

At first sight, the variety of equipment types and the complexities of sound behavior in different kinds of situations suggest formidable problems in formulating a meaningful noise rating for labeling purposes. It turns out, however, that a consideration of the manner and the locations in which the equipment will actually be used in practice can lead to great simplification. It is, in fact, possible for a (single) number on a label to relate directly both to the sound power output of the device and to the human effect of the noise in terms of the sound pressure level at the user's ear.
level at the user's ear.

The consumer needs only to be educated to know that the number on the label relates to the typical sound pressure level at his ear, as he uses the equipment. Technical people, who are likely to find the sound power level useful, will know from the text of the labeling regulation how to relate the number on the label to the corresponding sound power level in each case.

The conclusions stated above are valid only to the extent that sound in real rooms in dwellings behaves according to the acoustical theory presented in textbooks/ i.e., there exists a "direct" sound field near a point source, where the level diminishes at the rate of 6 dB per doubling of distance, and a "reverberant" field filling most of the rest of the room, where the level is almost uniform. In fact, however, most kinds of equipment that will be

considered for labeling are large enough that within the direct field they are not "point" sources; the attenuation with distance is more like 3 dB than 6 dB per distance doubled. Moreover, at distances far from the source, real rooms do not behave like the classical reverberant rooms of theoretical acoustics, but more like lined ducts; again, there is an attenuation of 3 dB per distance doubled, rather than a uniform sound level without significant spatial dependence.

The behavior of sound in real rooms can be illustrated by the preliminary measurements shown in Fig. 4-6. These

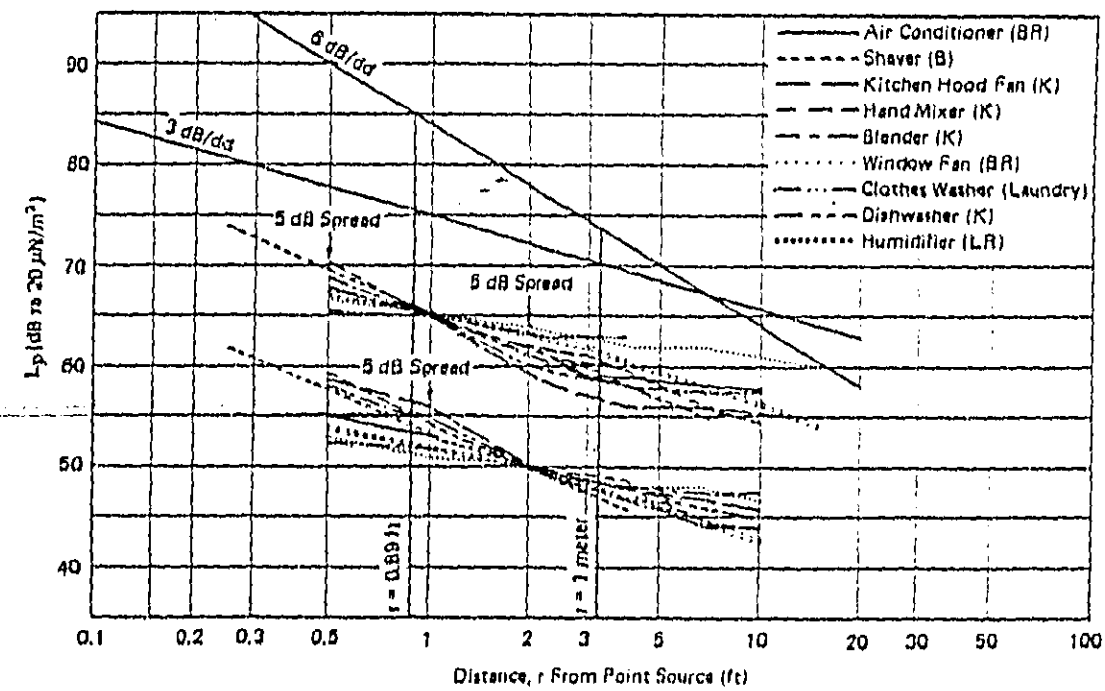


Figure 4-6. Preliminary Results of Measurements of Sound Attenuation vs Distance in Real Dwelling Rooms (Using Household Devices as Sources of Sound)

data come from typically furnished living rooms, bedrooms, bathrooms, kitchens, and laundry rooms, only one or two in each case. The same data are plotted in two ways: once with the sound pressure levels for all the devices normalized to be equal at 1 ft from the source and then with the levels normalized to be equal at 2 ft. Note that only for the electric shaver in the bathroom does the sound behave like that of a point source (6 dB per distance doubled) and only in one of the bedrooms and the laundry room does the sound level tend to a constant value at large distances. Instead, on average, there is, for most of the cases, a steady attenuation of 3 dB per distance doubled at all distances. Since the power level of the sources was not known, it is not yet possible to state a relation between sound power level and sound pressure level similar to that of Eq. 4-3 or Eq. 4-4.

APPENDIX A: OCTAVE BANDS THAT DOMINATE THE A-WEIGHTED SOUND LEVELS IN EQUIPMENT LIKELY TO BE LABELED (DOMINATING LEVELS ARE UNDERLINED).

Table C-1. Octave Bands of Equipment Likely to be Labeled

	Frequency						
Equipment	63	125	250	500	1000	2000	4000
Humidifer	44	60	60	59	52	49	41
A-weighted	18*	44	52	56	52	50	42
Floor Fan	50	55	52	48	44	40	33
A-weighted	24	39	44	45	44	41	34
Dehumidifier	40	58	45	44	43	40	30
A-weighted	14	42	37	41	43	41	31
Window Fan	57	65	61	58	53	50	44
A-weighted	31	49	53	55	53	51	45
Air Conditioner	52	70	63	58	55	54	48
A-weighted	26	54	55	55	55	55	49
Toilet	(50)	60	70	68	68	66	60
A-weighted	(24)	44	62	65	68	67	61
Dishwasher	63	68	66	63	57	51	45
A-weighted	37	52	58	60	57	52	46
Vacuum Cleaner	48	53	54	55	58	59	52
A-weighted	22	37	46	52	58	60	53
Food Blender	45	50	55	55	59	65	65
A-weighted	19	34	47	52	59	66	66
Electric Shaver	42	38	36	46	51	59	60
A-weighted	16	22	28	43	51	60	61
Food Disposal	60	72	58	53	55	55	55
A-weighted	34	56	50	50	55	56	56
Home Shop Tools	53	58	63	68	72	76	72
A-weighted	27	42	55	65	72	77	73
*A-weighting	-26	-16	-8	-3	0	1	1

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