L: File Hazmat Committee

P.L. Byers/ R.M James
Pgh 7

Joseph Damiano

This memo sheet is sized to ISO metric standard 86
125 mm x 176 mm.

To:

MEMBERS, HAZARDOUS MATERIAL CONTROL COMMITTEE

RE: KELLER, L.W.; K. L. SCHAPER AND C. D. JOHNSON, "A HAZARDOUS MATERIALS IDENTIFICATION SYSTEM FOR THE CASTINGS AND RESINS INDUSTRY," AIHAJ, DEC. 1980

The captioned paper is attached for your information.

Under the described system, respirators would tend to be over-used. This problem is indirectly acknowledged however; the bottom of Page 905 reads, "In the case of a proven ventilation system for vapor control, the respirator may be deleted from this index requirement."

JOE

Attachment

cc: J. R. Stemler/T. J. Rodjom/J. A. Shockey

ALCOA

Alcoa Laboratories
Alcoa Center, PA 15069

Several thousand raw materials ranging from naturally occurring minerals to highly toxic biocidal agents are employed in the manufacture of coatings and resins. The batch-type operations of this industry require employees to handle many different materials each day, so an easily recognizable and effective hazardous materials warning system is requisite. Such a system has been developed in the Coatings and Resins Division of PPG Industries and is called the "Safety and Health Index System". With this system, it is now possible for PPG employees to know the potential health, flammability and reactivity hazards associated with each bag or drum they may handle and take the necessary precautions to protect themselves.

A hazardous materials identification system for the coatings and resins industry

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introduction

The need for a hazardous materials identification system has long been recognized by health and safety professionals throughout the United States and the world. Many systems have been proposed and implemented to varying degrees, but the goal of a universally recognized and accepted system has not as yet been achieved.

The Industrial Hygiene and Safety Departments of PPG Industries' Coatings and Resins Division reviewed many existing systems and proposals to determine their applicability to the multi-chemical environment characteristic of many modern processing techniques.[1] One such system is that developed by the Labeling and Precautionary Information (LAPI) Committee of the Manufacturing Chemists Association (MCA) which has formed the basis for many voluntary labeling programs.[2] These same guidelines were adopted by the American National Standards Institute (ANSI) in their labeling standard, Z129.1-1976, for precautionary labeling of hazardous industrial chemicals.[3] These guidelines are based on the English language and while they detail hazards and precautions very well, they do not communicate this information in an expedient, easily recognizable fashion to production workers handling large numbers and quantities of raw materials on a daily basis.

The familiar "diamond-shaped" warning label employed by the National Fire Protection Association (NFPA) guidelines, "704M: Recommended System for the Identification of the Fire Hazards of Materials",[4] effectively communicates health, flammability and reactivity hazards stressing the fact that "the hazard degree should be assigned on the basis of the greater hazard that could exist *under fire or other emergency conditions*". This type of health hazard rating is inappropriate to address the acute and chronic hazards present in normal day to day operations. The 704M system also offers no suggestions for an appropriate personal protection strategy.

Proposals by the Department of Transportation for a Hazard Information System[5] and by the United Nations for a pictorial system[6] both suffer the same shortcomings in that they do not address all safety and health hazards, they do not warn of the degree of hazard for those which are addressed, nor do they recommend a protection strategy.

The Occupational Safety and Health Administration (OSHA) was given authority under the act (Section 6(b)(7)) to require "labels or other forms of warning as are necessary to insure that employees are apprised of all hazards to which they are exposed". In 1972, efforts began to address the mandated need for a "label or . . . warning" system. The National Institute for Occupational Safety and Health (NIOSH) developed a criteria document setting forth provisions for an identification system for occupationally hazardous materials.[7] Shortly thereafter, OSHA convened a Standards Advisory Committee on hazardous materials labeling.[8] Unfortunately, interests and approaches of the regulatory and consensus groups participating did not result in a viable system of hazardous material identification.

More recent governmental action in the form of the Toxic Substances Control Act gives the Environmental Protection Agency (EPA) authority to require (Section 6(a)(3)) labeling, warnings and instructions for the handling and use of chemicals in commerce.

By early 1976, it became apparent that a viable labeling proposal from OSHA was not to be issued in the immediate future, so our own needs for a hazardous materials

TABLE I
Hierarchy of Hazard

Numerical Rating	Degree of Hazard
4	Severe
3	Serious
2	Moderate
1	Slight
0	Minimal

TABLE II
Occupational Health Hazard Classification Guide*

Classification & Descriptive Terms	Short-Term Exposure	Long-Term Exposure
4 Extreme Health Hazard	Small quantities could cause major residual injury even though prompt medical treatment is given.	Major residual health effect likely when exposed to extremely small amounts.
3 High Health Hazard	Small quantities could cause serious temporary or residual injury even though prompt medical treatment is given.	Residual health effect likely when exposed to small amounts or low levels.
2 Moderate Health Hazard	Heavy exposure could cause temporary incapacitation or possible residual injuries unless prompt medical treatment is given.	Residual health effect or serious temporary injury likely when exposed to moderate amounts.
1 Slight Health Hazard	Exposures could cause irritation or minor residual injury if no treatment is given.	Temporary health effect likely when exposed to relatively large amounts.
0 No Significant Health Hazard	Heavy exposures could cause only minor irritation with no likelihood for residual injury.	No health effect expected, but may be a nuisance.

*To be used as a guide only. Professional judgment should be used in determining final classification.

identification system prompted us to reinstitute our early efforts to devise a system. This renewed effort not only reevaluated all governmental and consensus voluntary labeling programs, but also reviewed other systems already functioning in industry. This review led PPG personnel to the conclusion that no one existing system would satisfy all the following in-house objectives of a hazardous materials warning system.

objectives of the PPG hazardous materials identification system

1. The components of the system must be easily recognized.
2. The nature of the hazard(s) should be apparent (*e.g.*, health, flammability and reactivity).
3. The magnitude of the hazard should be identifiable to prevent over or under warning.
4. A hazard control procedure should be evident.
5. The system should be economical.
6. The system should be computer compatible to facilitate many forms of distribution.
7. The system should be broadly applicable to all phases of our operations.
8. The system must be based on *objective* criteria.

TABLE III
Examples of Health Hazard Ratings with the PPG SHIS

Rating Parameter	T.D.I.	Xylene	TiO_2 Pigment	Pb-Cr Pigment
Oral toxicity	1	1	0	1
Eye irritation	3	1	1	1
Skin irritation	3	2	1	2
Skin penetration toxicity	1	1	0	1
Inhalation toxicity	4	2	1	4
Sensitization potential	4	0	0	3
Chronic effects	4	1	0	4
Overall rating	4	2	1	4

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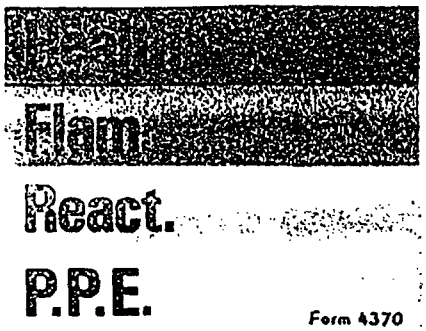


Figure 1 — PPG SHIS label.

A system has been developed using modifications of existing systems and many original ideas on effective communication of hazard and protection strategy. This system is the PPG Safety and Health Index System which satisfies our in-house objectives for a hazardous materials identification system and may have wide applicability throughout the chemical and process industries.

system description

general

The prime requisite for safe handling of potentially hazardous materials is hazard recognition and identification in such a way as to permit rapid evaluation of type of hazard, degree of hazard, and type(s) of personal protective equipment required. Experience with identification and recognition of large numbers of materials had taught us that use of chemical names was unsatisfactory owing to the numbers and complexity of nomenclature for our raw materials. Raw material identification has been shown through our experience to be most easily performed by a simple alphabetical and/or numerical code.

The PPG Safety and Health Index System (SHIS) is composed of four indexes. Three are numerical and assess the magnitude of health, flammability and reactivity hazards according to the hierarchy of hazard shown in Table I. The fourth index is composed of a single letter representing a combination of personal protective equipment (P.P.E.) to be used to protect various routes of entry into the body.

health hazard index

In the assignment of health hazard ratings, it was very desirable (and ultimately, very difficult) to employ an objective rating basis which could easily be correlated with the hierarchy of hazard shown in Table I. For selfish as well as economic reasons, it was desirable to use some proven rating system relevant to occupational exposure. Using the concept that there are no safe or hazardous chemicals, only safe or hazardous ways of using them, Dr. Henry F. Smyth, Jr. developed a privately circulated "Manual of Hazards to Health from Chemicals" during his work for the Chemical Hygiene Fellowship at Mellon Institute. This system has since been detailed in several reference works including the CRC Handbook of Analytical Toxicology.[9]

The descriptive terms and phrases used in the classification of chemicals with this system are shown in Table II. Each divisional raw material is rated objectively with the best available toxicological information according to the Smyth system and the hierarchy of hazard in each of the following categories:

- oral toxicity
- eye irritation
- skin irritation
- skin penetration toxicity
- inhalation toxicology (saturated vapor and/or varying concentrations)
- sensitization potential (skin and respiratory)
- chronic effects (including carcinogenicity, mutagenicity and teratogenicity)

Thus, the final health hazard rating for a material is determined by assigning the worst rating in any one category as the overall rating for the material. Several examples of health hazard ratings are shown in Table III.

flammability index

This index deals with the degree of susceptibility of materials to burning. The form and inherent properties of any material will affect its susceptibility as will conditions of use, sources of ignition present, bonding and grounding practices, etc. The criteria used to assign this index in the PPG SHIS are those found in NFPA 704-M[4] and are described briefly below:

Index	*Hazard*
4	*Severe* - very flammable gases or very volatile flammable liquids with flash points below 73 °F and boiling points below 100 °F (Class IA).
3	*Serious* - materials capable of ignition under almost all normal temperature conditions, including flammable liquids with flash points below 73 °F and boiling points above 100 °F, as well as liquids with flash points between 73 °F and 100 °F (Classes IB & IC).

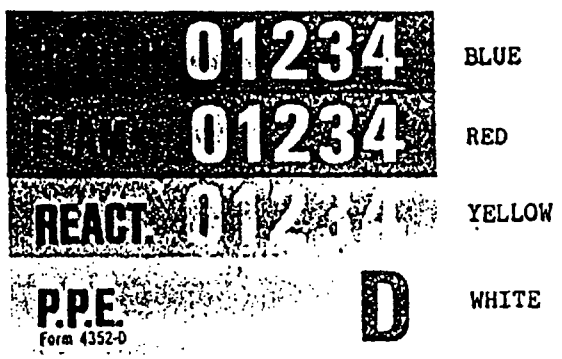
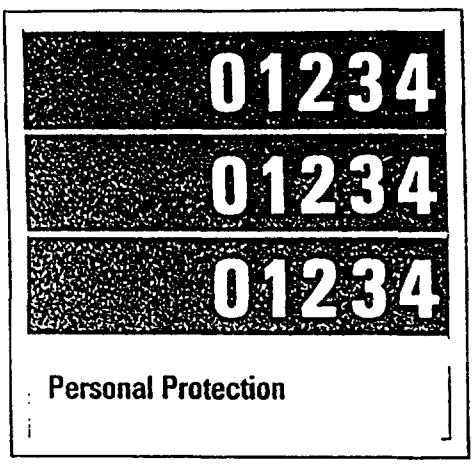


Figure 2 — PPG SHIS label - preprinted P.P.E. index.

Safety & Health Label

Coatings & Resins Division

PPG INDUSTRIES

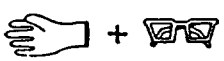


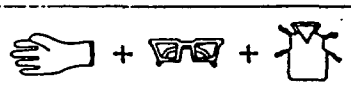
HAZARD INDEX

4 Severe Hazard
3 Serious Hazard
2 Moderate Hazard
1 Slight Hazard
0 Minimal Hazard

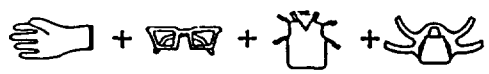
PERSONAL PROTECTION INDEX

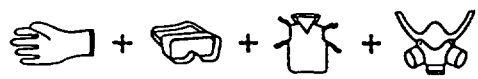
A 

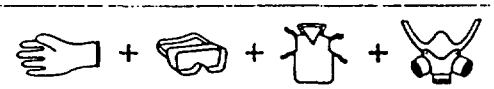
B 

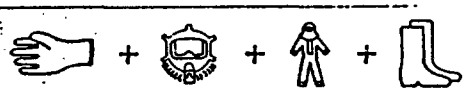
C 

D 

E  Dust Respirator

F  Vapor Respirator

G  Dust and Vapor Respirator

H 

X Used only with direct supervision.
SOP contains specific protective requirements.

Figure 3 — PPG SHIS wall poster.

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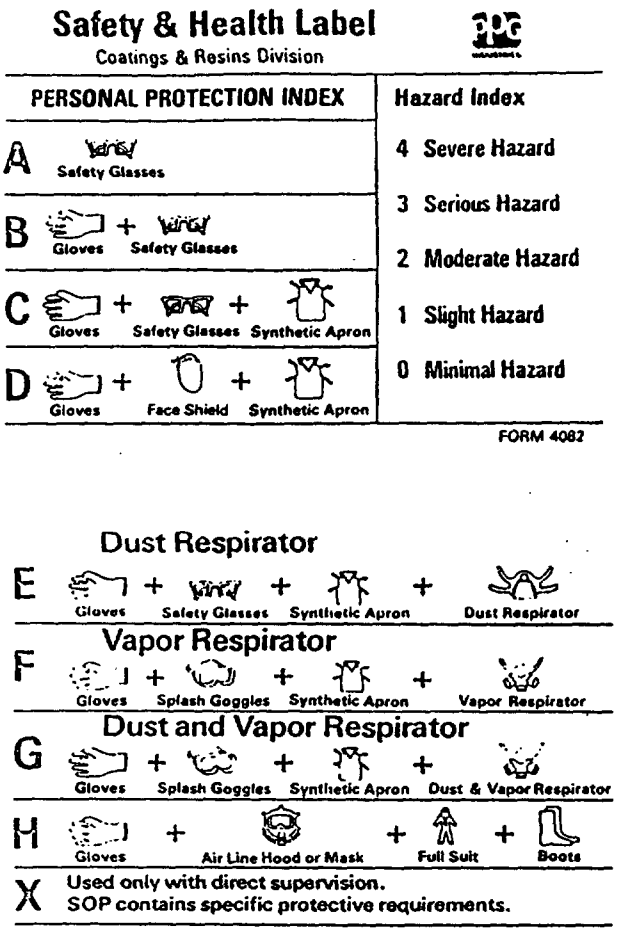

Figure 4 — PPG SHIS employee pocket card.

2 *Moderate* - materials which must be moderately heated before ignition will occur, including flammable liquids with flash points at or above 100 °F and below 200 °F (Classes II and IIIA).

1 *Slight* - materials that must be preheated before ignition will occur. Flammable liquids in this category will have flash points at or above 200 °F (Class IIIB).

0 *Minimal* - materials which are normally stable and will not burn unless heated.

reactivity index

Also using criteria adopted from NFPA 704M, this index deals with a material's degree of susceptibility to release energy. Although the criteria for assigning this index are sometimes modified for certain materials to reflect the industrial setting rather than fire conditions, the following NFPA definitions are used as guidelines:

Index	*Hazard*
4	*Severe* - these materials are readily capable of detonation or of explosive decomposition at normal temperatures and pressures.
3	*Serious* - materials which are capable of detonation or explosive reaction but require a strong initiating source or must be heated under confinement before initiation, or materials which react explosively with water.
2	*Moderate* - materials which in themselves are normally unstable and will readily undergo violent chemical change but will not detonate. These materials may also react violently with water.
1	*Slight* - materials which are normally stable but can become unstable at high temperatures and pressures. These materials may react with water but will not release energy violently.
0	*Minimal* - materials which are normally stable, even under fire conditions, and which will not react with water.

personal protective equipment index

The health hazard index serves to indicate the type(s) and degree of hazard associated with potential exposures. The development of a personal protection strategy correlated with route(s) of exposure turned out to be a formidable task, but was addressed by developing a hierarchy of combinations of personal protective equipment. While PPG provides extensive engineering and administrative controls to minimize employee exposure, the use of personal protective equipment is often necessary in the coatings industry as an additional precaution where operations are largely batch oriented involving a variety of materials. It is not unusual to find materials ranging from nuisance dusts to highly toxic or severely irritating chemicals in the same formulation, so personal protective equipment is employed as an adjunct to other controls.

While we may have preferred to use symbols or pictures of equipment, a concession to computer compatibility was made by assigning letters to represent combinations of equipment. The nine personal protective indexes have been assigned to represent the combinations of personal protective equipment listed below. They are arranged in combinations that will protect specific entry points into the body. For example, protection index F describes the protection strategy required for a material such as a solvent which might present a hazard through contact with the eyes (splash goggles), penetration through the skin (apron and gloves), or inhalation of vapors (vapor cartridge respirator). In the case of a proven ventilation system for vapor control, the respirator may be deleted from this index requirement. You will note that an X index has been included to designate those materials for which special precautionary measures must be taken as indicated in specific SOP's (Standard Operating Procedures) designed for this purpose.

Index	*Personal Protective Equipment*
A	Safety glasses
B	Gloves and safety glasses
C	Gloves, safety glasses, and synthetic apron

D	Gloves, face shield, and synthetic apron
E	Gloves, safety glasses, dust respirator, and synthetic apron
F	Gloves, splash goggles, vapor respirator, and synthetic apron
G	Gloves, splash goggles, vapor and dust respirator, and synthetic apron
H	Gloves, air line hood or mask, full suit and boots
X	Used only with direct supervision. Standard operating procedures must be developed to handle these very hazardous chemicals.

communication of the system

general

The one alphabetical and three numerical indexes assigned to each raw material serve no useful purpose unless this information is translated into visible, meaningful forms and interpreted for those it is designed to help, the production and laboratory employees. This is done via labels, posters, pocket cards, batch tickets, resin logs, computer printouts and an employee training program.

label

The PPG SHIS label is shown in Figure 1. The label comes in two sizes (2" by 2" and 8" by 8"), both of which are color-coded as follows: blue (health), red (flammability), yellow (reactivity) and white (personal protective equipment). The blank space at the top of the label is also white and may be used to designate a raw material's code number. The labels are printed at the plant and affixed to drums, pallets (at least four labels), piping, dispensing manifolds, etc. Care is taken not to obstruct other pertinent information or labels. Very hazardous materials such as lead and isocyanates may be so designated by printing extra statements such as "organic isocyanate" or "contains lead" in the P.P.E. section.

Where economics or printing capabilities do not permit plant generation of the labels, a slightly less desirable form is available (also in two sizes) as shown in Figure 2. This requires the stocking of a label for each of the P.P.E. designations (therefore, 9 in all). The proper health, flammability and reactivity indexes are then punched out, obliterated or otherwise properly denoted.

posters

Large posters (17" × 22") such as the one shown in Figure 3 are on prominent display throughout PPG coatings plants and are an important link in communicating elements of the system to employees. The poster shows a sample label, defines the hierarchy of hazard, and describes and illustrates the personal protective equipment required with each P.P.E. designation.

pocket cards

This small (2.5" × 3.5"), convenient card shown in Figure 4 communicates essentially the same information as the larger poster. It is carried by the employee to be used as a ready reference when other information sources are distant or lacking.

batch tickets/resin logs

This computer-generated form is essentially the "recipe" for manufacturing a batch of paint. Each raw material is shown with its assigned indexes, including their meaning, and a description of the hazards associated with it. For example, a material listed on the batch ticket with a P.P.E. of "D" would have associated with it the statement "Corrosive Eye-Skin Hazard", while an "E" would have "Lung-Skin-Eye/Dust Hazard".

The same general type of format and information is also found in PPG resin logs, the instruction sheets for production of resins.

employee training programs

A slide-cassette tape program consisting of 35 narrated visuals is presented to all employees at their orientation and subsequently during the year in group safety meetings. This program highlights all elements of the system in an understandable way and is reinforced by an illustrated booklet given to the employees after their viewing of the program.

computer information

In order to maintain a uniform index system throughout the division, control of code assignment is preserved by permitting only authorized personnel from the Divisional Industrial Hygiene Staff to input information to this system. Assigned indexes are stored on an interactive computer from which maintenance is transmitted to plant locations periodically in hard copy form to be added to an existing "Safety and Health Index" binder. In addition, this information is maintained on the PPG Corporate Supply File so that computer-generated batch tickets display the proper indexes.

evaluation of the system

subjective

A major element of all comprehensive divisional industrial hygiene surveys is an evaluation of work practices and efficacy of existing occupational health programs. Based on interviews and observations by our divisional industrial hygienists and safety personnel during surveys, the PPG SHIS is well accepted, understood and appreciated. Employee comments have indicated that this method of communicating hazard is preferable to other more verbose warning labels.

As an indicator of understandability, we have presented this system to our French affiliate. The feared language barrier did not materialize and adoption of the system went smoothly.

objective

An independent measurement consultant has been hired to review existing training materials, provide an objective evaluation tool, implement mechanisms for allowing future changes and enhancements, and assess impact, utility, effectiveness, acceptance and workability. This work is still proceeding as of this writing, so no definite results are yet known.

trade association

PPG, as an active member of the National Paint and Coatings Association (NPCA), serves on its Occupational Health and Safety Task Forces and offered the SHIS for NPCA's consideration as their recommended hazardous materials information system. The association deemed the PPG system superior to its available alternatives, accepted and modified it for their own uses, and has recommended it to their 1200 members. The Canadian Paint Manufacturers Association (CPMA) has followed suit and adopted the NPCA version for Canadian operations.

summary

The system described is by no means perfect, but it has been favorably received by our domestic and overseas operations and satisfies our goals in providing a hazardous materials warning system.

Convention of spatial arrangement and color make the device easily recognized.

The nature of health hazards is defined in magnitude and mode of encounter. Flammability and reactivity hazards are defined in terms of magnitude.

A health hazard control procedure is defined by a protective equipment hierarchy.

The single device provides economy.

The use of alpha and numeric representation allows for computerization.

The system is flexible and can be adapted to various types of environments and existing control measures.

The indexes are all based upon objective data.

acknowledgement

Special thanks are extended to Mr. J. A. Kassekert, without whose management support the system would have failed. Messrs. R. Miller, B. Walker and R. Leader's contributions have also been invaluable.

references

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