THE CHEMICAL AND DYESTUFF RATING PLAN

BY

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The customary procedure for the segregation of risks into rate groups for casualty insurance purposes, particularly in workmen's compensation, is to erect classifications which are broadly descriptive of (1) a product, (2) a process, *or* (3) a business. Few, if any, classifications involve more than one of these three principles. For example, we have in our compensation manual, "Boot and Shoe Mfg." This is a typical "product" classification and any manufacturer of shoes is included in this classification irrespective of whether he makes his shoes by hand or whether his factory is equipped with the most up-to-date machinery. Other classifications such as "Electroplating" are based upon a particular "process." In such a classification we would include a risk using this process irrespective of whether the metal used in the plating process was copper, or silver, or nickel—or whether the objects plated were small pieces of metal or were heavy machinery parts.

At only one point in the compensation classification system is there any definite attempt to combine more than one of the classification principles enumerated above, in the determination of the manual rates. The Chemical and Dyestuff Rating Plan is the exception. In this plan we take into consideration *both* the raw materials or products on the one hand, and the processes involved, on the other. Because the plan is somewhat unique, a brief description both of its makeup and the manner of its application may be of interest.

Certain chemical products and processes have always been, and still are covered by separate classifications of the usual type —that is, they are purely product classifications such as, "Acid Mfg." or they are process classes such as "Distilling." These classifications cover broad and fairly well established industries in which the individual risks, in the opinion of the underwriters, are sufficiently homogeneous to warrant the use of classifications which follow the customary classification principles. On the other hand, it has been recognized that there are numerous risks which manufacture chemicals or dyestuffs or where the primary

hazard is of a chemical nature, which have materially different characteristics and potential hazards. The number of risks of a similar nature is so small, however, that it is impracticable to set up separate classifications because the exposure for any homogeneous group of risks would be too small to obtain any practical statistical or rate making value. Prior to the establishment of the Chemical and Dyestuff Rating Plan, these risks were included in a single classification with an "A" rate. This procedure meant that the particular rate making organization having jurisdiction over the risk would establish a basic rate for that risk based upon its judgment of the particular hazards involved. However, because there were no uniformly recognized principles for the establishment of such "A" rates for chemical risks, there was little consistency in the method of rating them.

During the general revision of rates and of manual classifications which was undertaken by the then newly established National Council on Workmen's Compensation Insurance in 1920, the General Rating Committee recognized the desirability of establishing some fixed procedure in the establishment of rates for such risks that might be uniformly applied in all states. To this end a sub-committee was appointed to develop such a plan. The underwriters which formed this committee solicited the aid of technical experts connected with the rating bureaus and the insurance companies. After careful study of the problem, and an elaborate investigation into the many hazard producing elements presented by chemical risks, the sub-committee presented a plan which was officially put into effect on April 1, 1921. Although there have been, from time to time, some minor changes in the technical details as respects the chemical ingredients recognized or the specific processes considered in the application of the plan, no fundamental change has been made since its original adoption. Therefore, in our particular discussion of the Chemical and Dyestuff Rating Plan it seems desirable that we describe it as it stands today.

Scope of Plan

Although the Chemical and Dyestuff Rating Plan was established primarily for the purpose of classifying and rating risks engaged in the manufacture of chemicals and dyestuffs, it is also

applied to those risks which present hazards which are primarily of a chemical nature, although the chemicals and dyestuffs are not actually manufactured by the risk. There are many risks which engage in the simple mixing, canning or bottling of materials which, to quote from the plan, are "flammable, poisonous, caustic or corrosive." Because the governing hazards of such risks are primarily chemical, the Chemical and Dyestuff Rating Plan contemplates the inclusion of such risks, as well as those which actually manufacture the chemicals themselves.

As already noted, there are a number of specific classifications in the compensation manual which cover the manufacture of certain chemicals. The Chemical and Dyestuff Rating Plan does not apply where the operations are specifically classified in the manual, but is only used where there is no appropriate individual classification. Since the introduction of the Chemical and Dyestuff Rating Plan, there has been a tendency to reduce the number of such specific classifications and to incorporate any risks formerly classified thereunder in the Chemical Plan.

Fundamental Principles

As suggested above, risks which are included in the Chemical Plan are grouped both with respect to (1) the degree of hazard involved in the raw materials or the final products, and (2) by the hazard created by or during the processes of transforming the raw materials into the final product. The hazard created by the substances used or manufactured is measured in terms of "flammability" or their explosive hazard.

In application, the plan consists of a diagram of 24 squares, each of which represents a classification of risks with certain distinguishing characteristics as to raw materials, products and processes.

Appendix I shows a typical "diagram" or "rate sheet" for a given state. In the diagram the vertical columns (abscissae) represent the degree of hazard of the raw materials and products from the standpoint of flammability, and the horizontal lines of the diagram (ordinates) represent the degree of hazard of the processes involved.

The flammability or explosion hazard of a material is measured in terms of "flash-point" which is defined as "the specific

temperature lower than the boiling point at which a volatile substance gives off vapor in sufficient quantity to ignite momentarily with a slight explosion on the approach of a flame." "Flash-points" have been grouped into four classifications in diminishing order of hazard as follows:

(a) Flash-point—0° F. or below.
(b) Flash-point—0° F. to 80° F.
(c) Flash-point—80° F. to 125° F.
(d) Flash-point—over 125° F.

The plan contains an alphabetical list of the usual raw materials and products found in the rating of chemical risks, which list is known as "Table A." Following the name of each substance is a letter indicating the particular group into which the material falls as respects its "flash-point." This Table is currently reviewed by the technical representatives of the carriers on the basis of current chemical information. Appendix II represents a typical page of Table A, which, in all, lists some 350 different chemical substances.

As previously stated, the horizontal lines or "ordinates" in the diagram represent various chemical processes grouped in the order of their hazards. As a part of the plan, there is another table—"Table B," which specifically describes the various processes that are commonly encountered in this type of risk. Briefly these ordinates embrace the following:

1. Process highly flammable or explosive.
2. Process flammable or explosive or involving the generation or use of intensely poisonous gases or substances.
3. Process slightly flammable or explosive or involving the generation or use of highly poisonous substances.
4. Process involving the generation or use of strongly caustic, corrosive or poisonous substances.
5. Process involving the generation or use of slightly caustic, corrosive or poisonous substances.
6. Process non-hazardous.

Appendix III gives a typical page of Table B and will indicate the manner in which the various processes are described. Appendix IV includes a list of all of the several processes that are included in each group. It will be noted that among the processes

indicated as hazardous, are those which involve the generation or use of certain poisonous, caustic or corrosive gases or substances. These gases or substances are listed in the appropriate ordinate of Table B, but in addition they are listed in Table A with an appropriate number indicating their particular degree of "process hazard" or, in other words, the ordinates which should be used in applying the plan, if that particular gas or substance is encountered.

Method of Application

When a risk within the scope of the plan comes to the attention of the rating organization having jurisdiction, a special inspection is made to determine its various characteristics from a chemical standpoint. A special report form is used for this purpose which is designed to bring out all of the various chemicals which are used in the manufacture of the finished product, and detailed descriptions are required of each of the several processes that are involved. In many states, particularly where the chemical industry is important, the rating bureau assigns a special inspector for investigations of this kind—this inspector having a special knowledge of chemical processes.

After the inspection has been made the rating bureau reviews the data and assigns a classification and rate applicable to that risk. In general, the Chemical Plan contemplates the establishment of a single classification and rate to cover all of the chemical manufacturing operations of the assured, this classification and rate to be that resulting from the application of the plan through consideration of the most hazardous raw material or product and the most hazardous process involved.

From the inspection report form, the rater lists the raw materials and products, and then through reference to Table A of the chemical plan determines the proper column of the diagram (abscissa) corresponding to the *most flammable* raw material or product involved. Correspondingly, Table B is reviewed to determine the *most hazardous* process involved, which gives the proper horizontal line or ordinate of the diagram.

The classification and rate for the risk in question will then be located in the diagram at the intersection of the column (abscissa) and the horizontal line or ordinate. In Appendix V

are given two typical examples of the simple application of the Chemical and Dyestuff Rating Plan.

Average Rating

As previously stated, the Chemical Plan normally contemplates that a single classification and rate shall be determined to cover all of the chemical manufacturing operations of the assured based upon the most hazardous raw material or product on the one hand, and the most hazardous process involved on the other. There are, however, certain exceptions to this general rule. If the risk involves a number of distinct chemical processes which involve varying degrees of hazards, recognition of these distinct processes is made if the following conditions are complied with:

(a) There is no interchange of labor among the several distinct processes.
(b) The separate operations are conducted in separate buildings or contiguous structures having a party wall which is substantial and continuous from cellar to roof.
(c) In the case of particularly hazardous operations of a flammable or explosive nature (as contemplated by abscissae A and B or ordinates 1 and 2), such separations of departments must be made by fire walls, the only openings in which are provided with standard fire doors.

Where a risk qualifies for such "average rating" treatment, a rate is first established for each "distinct process" in accordance with its governing hazards as respects raw materials or products and processes. A composite rate is then determined by combining the several individual rates into a weighted average;—the combination to be made upon the basis of the number of employees to which each individual rate is applicable.

This principle of average rating also is used for the purpose of including in the final rate for a risk, a department in which the predominating hazard is not primarily chemical in nature, but in which operations are conducted which are incidental to the chemical process. In such cases the non-chemical department enters into the average rating at the manual rate for the classification in the manual which best describes the operations performed in that department.

In cases where average rates are determined, the plan does not provide directly a statistical code number. To provide for such cases a separate group of code numbers has been set apart —these numbers running from 4860 to 4883. The classifier in coding an average rated risk must determine the code number on the rate sheet which provides a rate nearest the rate developed by average rating and then assign to the specific risk a code number 60 numbers higher than the number on the rate sheet.

Appendix VI gives an example of how an average rate is determined through the application of the Chemical and Dyestuff Rating Plan.

Rates

The original rates that were used in connection with the Chemical and Dyestuff Rating Plan were based almost entirely upon the judgment of the chemical engineers who were responsible for the technical details of the plan. Of course, in establishing these rates, analogies were made to the existing classification experience on a number of chemical industries, but, in general, the relationship between the various rates in the plan were based upon the engineers' judgment as to the relative hazards of the flammability of various materials and the hazards of different chemical processes. When the plan was developed it was assumed that the decrease in hazard for each of the groupings of "flammability" corresponded to the decrease in hazard for each of the different classifications of "process." Accordingly, the rates for the squares on the diagonals of the diagram were uniform. Thus, the same rate applied to code 4801 (B-1) as for code 4804 (A-2), and so on throughout the diagram. (See Appendix I.)

Because of the delay in the collection of accident statistics under Schedule Z, little data was available until the fall of 1926 when the experience for policy years 1921, 1922 and 1923 was combined. Even then the data was extremely limited except for a few classifications. Almost 50 per cent. of the total payroll exposure under the plan as a whole was concentrated in code 4815, and so the revision of rates at that time constituted little more than the development of a rate for code 4815 (D-4), and adjusting the other rates to maintain the previous hazard differential.

There has just become available to the National Council on Compensation Insurance the experience under the Chemical Plan

for policy years 1925 to 1929, inclusive. This experience covers some $140,000,000 of payroll. Approximately 50 per cent. of this payroll exposure has been developed in those statistical code numbers which involve "average rating," and inasmuch as the experience in such statistical code numbers does not represent the hazards of any separate or particular chemical process, it is doubtless improper to use such experience in the determination of the relative hazards of the various groups of flammability and the classification of processes that are used in the plan. It is unfortunate that of the remaining experience, 85 per cent. of the payroll is concentrated in five of the twenty-four classifications, and that about 45 per cent. of all of the payroll available for the determination of the relative hazards of the several classifications is concentrated in one square—code 4815 (D-4).

In spite of this concentration of experience in a few classifications, it seems reasonably possible to develop certain conclusions as to the relative hazards of the several items that go to make up the Chemical Plan. For the purpose of study, the experience of the four classifications in each process group were combined, and the results compared to determine whether or not there appears to be a difference in the hazards of the several process groupings as is assumed in the plan.

Chart No. 1 shows the results of these combinations. In this diagram, total pure premiums in terms of percentages have been plotted for the four classifications under each process. Because of the large volume of data in process group 4 it was decided to consider that group as the basis or 100 per cent. on the Diagram. Unfortunately, the volume of experience in process groups Nos. 1 and 2 was too small to be of any dependable value, and the same was true of the "serious" (death, permanent total and major permanent partial) experience in groups 5 and 6. Based upon the data now available, it seems that we can be reasonably justified in the conclusion that the hazards of processes in group 6 are approximately 50 per cent. of the hazards of those in group 4; that the hazards of group 5 processes are approximately 75 per cent. of those in group 4; and that processes in group 3 represent hazards approximately 150 per cent. of those in group 4. The data with respect to processes in groups 1 and 2 are by no means conclusive, and, for that reason, I would hesitate to conjecture even the approximate hazards of these two groups.

Unfortunately, the determination of the hazards of the several groups of flammability is not as simple a problem because of the fact that practically all of the exposure is concentrated in those classifications that come in abscissa D. However, Chart 2 has been prepared showing the total pure premiums (in terms of percentage) for the combined experience for the six classifications in each of the several flammability groups using group D as the starting point for making comparisons. Although there is some upward trend from group D, the results are not entirely convincing. Based upon five years of countrywide exposure, the maximum differential in these flammability groups is slightly less than 25 per cent., whereas, in the original plan it was assumed that the differential was in the order of 200 per cent. Admitting that the volume of data for flammability groups A, B and C is somewhat limited, it seems probable that the original judgment of the chemical engineers who developed the plan, somewhat exaggerated the flammability or explosive hazard of the various chemicals that enter into the assignment of rates under the plan. It is quite probable that the hazards of flammability are of a catastrophic nature, which would not evidence themselves in the experience until an extremely broad volume of exposure had been developed, but on the basis of the available data, it would appear that the premise of using uniform rates for the diagonal squares in the diagram cannot be justified because the hazard differentials for the processes appear to vary more markedly than do the hazard differentials for the flammability groups. Chart No. 3 has been prepared showing the original rate differentials (in terms of percentage) for the several squares in the diagram using code 4815 as the starting point. At the righthand side of this same chart is a suggested hazard grouping, again using code 4815 as the basis. In this diagram the relative hazards for the several processes have been based upon the adjusted total pure premiums as indicated in Chart No. 1. For the relative hazards of the flammability groups, it has been assumed that the flammability hazard of group C is 5 per cent. greater than for the corresponding hazards for the classification in group D; that the hazards of group B are 10 per cent. greater than group C; and that the hazards in group A are 15 per cent. greater than group B. Whether or not the relative hazards as indicated by this suggested diagram are approximately correct can definitely be

proven only when a still greater volume of data is available, particularly in those classifications in the higher hazard groups of both process and flammability, but from our present data it would appear that the original conception of the flammability hazards was somewhat exaggerated.

Conclusion

After approximately ten years of use, I think it can be stated quite safely that the Chemical and Dyestuff Rating Plan has served a very useful purpose in determining the classifications and rates for such a heterogeneous group of risks as are encountered in the chemical industry. To establish individual classifications which would properly treat the multiplicity of hazards that are present in the chemical field would be a practical impossibility both from the standpoint of the development of appropriate classification phraseology and because each such classification would probably never develop enough statistical data upon which to base reasonable rates. The use of the "two way" plan has, undoubtedly, been better than any single basis for the determination of hazards, although, as previously stated, it does appear from the current experience that the hazards of flammability have been somewhat exaggerated.

It is true that the results of experience rating risks which are subject to the Chemical Plan have shown wide fluctuations from the basic rates—probably as great as for any other group of risks. But it is doubtful if we could expect any different result. The chance of the "final adjusted rate" as developed by an experience rating plan, coinciding with the actual basic rates is small even in a group of risks that is exactly described by the classifications in which they are grouped. In addition to the low expectancy of accidents which make a chance occurrence of considerable importance, there are many other variables that cannot be recognized in any classification phraseology regardless of how careful that description has been drawn. Refinements in processes, the character and conditions of the physical equipment, the general characteristics of the employees (particularly with respect to the knowledge of their work and their attitude toward safe practices), and the wage rates which are paid in comparison to the average in the industry are only a few of the

factors that enter into this problem. Therefore, I think that it would be too much to expect that the results of experience rating risks which enter into the Chemical Plan should closely agree with the basic rates.

Whether or not the general principle of using two basic principles of classification—that of the hazards of the raw materials and products on the one hand, and the hazards of the processes involved, on the other—can be incorporated in the classification of other types of risks is open to question, but insofar as chemical risks are concerned, this plan seems to be serving a very useful purpose.

CHEMICAL AND DYESTUFF RATING PLAN. ORIGINAL PRINTING

NOTE:—Code Numbers in parenthesis are to be used in connection with risks classified under the principle of average rating. See rule 5 on page 3 of the Chemical and Dyestuff Rating Plan.

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ORDINATES	ABSCISSAE—FLAMMABILITY			
PROCESSES	A Substances flashing at 0° Fahrenheit or less	B Substances flashing at 0° to 80° Fahrenheit	C Substances flashing at 80°—125° Fahrenheit	D Substances flashing at more than 125° Fahren.
1 Process highly flammable or explosive.	**4800-(4860)** Rate 12.68 Min. Prem. 213. Excess .379 Ex-Med. .13 L. & E. Constant 23.	**4801-(4861)** Rate 10.57 Min. Prem. 182. Excess .379 Ex-Med. .13 L. & E. Constant 23.	**4802-(4862)** Rate 9.48 Min. Prem. 165. Excess .380 Ex-Med. .13 L. & E. Constant 23.	**4803-(4863)** Rate 8.46 Min. Prem. 150. Excess .380 Ex-Med. .13 L. & E. Constant 23.
2 Process flammable or explosive or involving the generation or use of intensely poisonous gases or substances.	**4804-(4864)** Rate 10.57 Min. Prem. 182. Excess .379 Ex-Med. .13 L. & E. Constant 23.	**4805-(4865)** Rate 9.48 Min. Prem. 165. Excess .380 Ex-Med. .13 L. & E. Constant 23.	**4806-(4866)** Rate 8.46 Min. Prem. 150. Excess .380 Ex-Med. .13 L. & E. Constant 23.	**4807-(4867)** Rate 6.20 Min. Prem. 116. Excess .378 Ex-Med. .13 L. & E. Constant 23.
3 Process slightly flammable or explosive, or involving the generation or use of highly poisonous substances.	**4808-(4868)** Rate 9.48 Min. Prem. 165. Excess .380 Ex-Med. .13 L. & E. Constant 23.	**4809-(4869)** Rate 8.46 Min. Prem. 150. Excess .380 Ex-Med. .13 L. & E. Constant 23.	**4810-(4870)** Rate 6.20 Min. Prem. 116. Excess .378 Ex-Med. .13 L. & E. Constant 23.	**4811-(4871)** Rate 4.74 Min. Prem. 94. Excess .374 Ex-Med. .17 L. & E. Constant 23.
4 Process involving the generation or use of strongly caustic, corrosive or poisonous substances.	**4812-(4872)** Rate 8.46 Min. Prem. 150. Excess .380 Ex-Med. .13 L. & E. Constant 23.	**4813-(4873)** Rate 6.20 Min. Prem. 116. Excess .378 Ex-Med. .13 L. & E. Constant 23.	**4814-(4874)** Rate 4.74 Min. Prem. 94. Excess .374 Ex-Med. .17 L. & E. Constant 23.	**4815-(4875)** Rate 4.39 Min. Prem. 89. Excess .404 Ex-Med. .16 L. & E. Constant 23.
5 Process involving the generation or use of slightly caustic, corrosive or poisonous substances.	**4816-(4876)** Rate 6.20 Min. Prem. 116. Excess .378 Ex-Med. .13 L. & E. Constant 23.	**4817-(4877)** Rate 4.74 Min. Prem. 94. Excess .374 Ex-Med. .17 L. & E. Constant 23.	**4818-(4878)** Rate 4.39 Min. Prem. 89. Excess .404 Ex-Med. .16 L. & E. Constant 23.	**4819-(4879)** Rate 3.63 Min. Prem. 77. Excess .344 Ex-Med. .13 L. & E. Constant 23.
6 Process non-hazardous.	**4820-(4880)** Rate 4.74 Min. Prem. 94. Excess .374 Ex-Med. .17 L. & E. Constant 23.	**4821-(4881)** Rate 4.39 Min. Prem. 89. Excess .404 Ex-Med. .16 L. & E. Constant 23.	**4822-(4882)** Rate 3.63 Min. Prem. 77. Excess .344 Ex-Med. .13 L. & E. Constant 23.	**4823-(4883)** Rate 2.41 Min. Prem. 59. Excess .372 Ex-Med. .18 L. & E. Constant 23.

APPENDIX II

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TABLE A.★

Classification of Chemicals According to Relative Fire and Explosive Hazard.

(To be used in determining column (Abscissa) of Rating Diagram for each raw material and finished product.)

Group (A) includes all chemicals, liquid or solid, having flash-points of less than zero degrees F.

Group (B) includes all chemicals, liquid or solid, having flash-points between zero and 80 degrees F.

Group (C) includes all chemicals, liquid or solid, having flash-points between 80 and 125 degrees F.

Group (D) includes all chemicals, liquid or solid, having flash-points over 125 degrees F.

A

*Acetate, Amyl (B) (4)
Acetate, Butyl (B)
Acetate, Ethyl (B)
Acetate, Methyl (B)
*Acetic Acid (glacial) (C) (4)
*Acetic Acid (D) (5)
Acetone (B)
Acetyl Chloride (B)
Acetylene (A)
*Acrolein (D) (4)
*Alcohol, Amyl (C) (4)
Alcohol, Benzyl (D)
Alcohol, Butyl (Butanol) (B)
*Alcohol (denatured) (B) (4)
Alcohol, Ethyl (Ethanol) (B)
Alcohol, Isobutyl (B)
*Alcohol, Methyl (Methanol) (B) (4)
Alcohol, Propyl (B)
Alcohol, Vinyl (B)
*Alcohol, Wood (B) (4)
*Aldehydes (D) (4)
Alpha Naphthylamine (D)
Aluminum Dust (B)
Aminoazobenzene (D)
*Ammonia (D) (4)
*Ammonia, Anhydrous (D) (4)
*Ammonium Hydroxide (D) (5)
Ammonium Nitrate (D)
Ammonium Nitrite (D)
Ammonium Perchlorate (D)
Ammonium Permanganate (D)
Ammonium Picrate—10 per cent. water or more (B)
Ammonium Picrate—less than 10 per cent. water (A)
*Amyl Acetate (B) (4)
*Amyl Alcohol (C) (4)
*Aniline Oil (D) (3)
Aniline Salts (D) (3)
Anthracene Oil (D)
Anthraquinone (D)
*Antimony Sulphide (D) (4)
*Antimony Trichloride (D) (4)
*Antimony Trioxide (D) (4)
Argon (D)
*Arsenic (white) (D) (3)
*Arsenic Acid (D) (3)
*Arsenic Trioxide (D) (3)
*Arseniuretted Hydrogen (D) (2)
*Arsenous Chloride (D) (3)
*Arsine (D) (2)

B

Barium Chlorate (D)
*Barium Nitrate (D) (3)
Barium Peroxide (D)
Benzaldehyde (D)
Benzidine (D)
Benzidine Sulphate (D)
Benzidine Sulphite (D)
*Benzine, (high test gasoline) (A)
*Benzol (benzene) (B) (3)
Benzyl Alcohol (D)
*Benzyl Chloride (D) (4)

Substances marked with an (*) are also to be considered in connection with processes. See Table "B." The figures in parentheses indicate the Ordinate of Table "B" in which the substance is to be found.

APPENDIX III

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TABLE B. ★

Classification of Chemical Processes According to Relative Hazard.

(To be used in determining line (Ordinate) of diagram for each chemical process.)

Ordinate 1. *Nitration.* The process by means of which the radical (NO_2) is introduced into a compound so that it combines directly by means of its nitrogen with carbon. It is usually done in one of the following ways:

(a) The substance is treated with a mixture of strong nitric and sulphuric acid, usually in an iron vessel called a nitrator.

(b) The substance is added to sodium nitrate and strong sulphuric acid added, in a nitrator.

(c) In some cases strong nitric acid alone is added to the substance to be nitrated.

(d) In a few cases nitrous gases or sodium nitrate in acid solutions are used.

Ordinate 2. *Use of Autoclaves or pressure apparatus generating more than 50 lbs. per sq. in. pressure.* This refers to the type of operation in which the reaction is carried on in a closed container.

The materials are put in, apparatus closed, reaction incited (usually by heat) pressure is created, pressure reduced at completion of reaction.

Alkylation generating pressures of more than 50 lbs. per sq. in. at any time during the process. The process of introducing a hydrocarbon radical (such as methyl CH_3, ethyl C_2H_5, butyl C_4H_9) into a compound in place of hydrogen. The alcohols, with hydrochloric acid, or methyl or ethyl chloride, also methyl or ethyl sulphate, are most commonly used, and the operation is frequently effected at elevated temperature under pressure in an autoclave.

Processes generating or using the following intensely poisonous gases or substances.

Arseniuretted Hydrogen
Arsine
Calcium Cyanide
Carbon Monoxide
Cyanogen
Ethyl Phosphine
Hydrocyanic Acid
Hydrogen Phosphide
Lead Compounds (see Table A-1)
Nicotine
Phosgene
Phosphine
Phosphuretted Hydrogen
Potassium Cyanide
Potassium Nitrocyanide
Prussic Acid
Sodium Cyanide

APPENDIX IV

Chemical Processes Recognized in the Chemical Plan.

Ordinate 1. *Nitration.*

Ordinate 2. *Use of Autoclaves or pressure apparatus generating more than 50 lbs. per sq. in. pressure.*

Alkylation under pressure.

Processes generating or using intensely poisonous gases or substances.

Ordinate 3. *Dry grinding and pulverizing of dyes.*

Distillation involving substances having a flash-point below 125°F.

Reduction of organic compounds followed by distillation.

Oxidation.

Use of powerful oxidizing agents.

Sulphonation.

Compression of gases.

Processes generating or using highly poisonous substances.

Ordinate 4. *Halogenation.*

Amidation.

Alkylation not under pressure.

Processes involving the generation or use of strongly caustic, corrosive or poisonous substances.

Ordinate 5. *Processes involving the generation or use of slightly caustic, corrosive or poisonous substances.*

Ordinate 6. *Processes not explosive or flammable and which do not generate or require the use of any caustic, corrosive or poisonous materials.*

APPENDIX V

EXAMPLE NO. 1

Product: Aniline Oil.

Raw Materials: Benzol
Iron Filings
Hydrochloric Acid
Mixed Acid

Process: Benzol (benzene) is washed and nitrated with mixed acid. The resulting nitro benzol is reduced by the action of iron filings and hydrochloric acid, the product, aniline oil, being recovered by distillation.

In this particular case, the most dangerous raw material from the standpoint of flammability or explosiveness is Benzol. This substance has a flash-point of approximately 20° F. and falls in Abscissa (B). The other raw materials or the product would not in this case receive consideration inasmuch as they are less flammable than Benzol.

The most dangerous operation is the nitrating process which falls in Ordinate (1). None of the other processes involved will receive consideration in this case as they are less hazardous than nitration.

The rate for these operations would be taken from the Plan where Abscissa (B) and Ordinate (1) cross.

EXAMPLE NO. 2

Product: Silicate of Soda

Raw Materials: Silica (sand)
Soda Ash

Process: Silica and soda ash are melted together in a coal-fired retort. The resulting product is run by gravity to an absorber containing water. Here the silicate of soda is dissolved and later evaporated to the proper consistency.

In this case the Raw Materials and Product are non-flammable, Abscissa (D). The process involves the use of soda ash, which is considered "slightly caustic" and the rate would be taken from the point where Ordinate (5) crosses Abscissa (D).

APPENDIX VI

EXAMPLE OF AVERAGE RATING

Products:	Sulphuric Acid Barium Nitrate Nitro Benzol
Raw Materials:	Pyrites Sulphur Sodium Nitrate Barium Carbonate Benzol Nitric Acid
Process:	Pyrites or sulphur or both are burned and the sulphur dioxide gases produced are converted by reaction with the sodium nitrate into sulphuric acid gases which when condensed in lead chambers or by "contact" with catalyzer become sulphuric acid. Barium carbonate when reacted upon by nitric acid produces barium nitrate. This crystallized, filtered and dried is in commercial form. The agitation of benzol and nitric acid produces nitro benzol. This product is washed and distilled and redistilled until purified.

This example assumes that the several products are manufactured separately as defined under the exception to paragraph 5 of the "Principles Underlying the Plan."

The manufacture of sulphuric acid is a manual classification—Acid Mfg. (heavy) 4548; consequently this process should be given the rate for that classification.

For the production of barium nitrate, all the raw materials and the product have flash-points above 125° F., therefore Abscissa (D) applies. The product, however, is an oxidizing agent. Ordinate (3) and Abscissa (D) will consequently determine the rate.

In producing nitro benzol, the benzol is the most flammable of the Raw Materials or Product. Abscissa (B) will then apply. The process involves the dangerous operation of nitration and so will be considered under Ordinate (1). The intersection of Abscissa (B) and Ordinate (1) will give the rate.

The rate of the plant manufacturing the products herewith mentioned can now be established by averaging the rates

APPENDIX VI—(Continued)

for the classification "Heavy Acid Manufacturing" and those produced by the plan, Abscissa (D) Ordinate (3) and Abscissa (B) Ordinate (1). To indicate the method of calculating the average rate let us assume the following conditions:

Operation	Employees*	Rate
(a) Acid Mfg.	20	$4.01 (No. 4548)
(b) Barium Nitrate	60	4.25 (D—3)
(c) Nitro Benzol	10	8.47 (B—1)
	90	

To establish average rate for the operations proceed as follows:

(a)	$4.01 x 20 (Employees)	= 80.20
(b)	4.25 x 60 "	=255.00
(c)	8.47 x 10 "	= 84.70
		419.90

$\frac{419.90}{90} = 4.67 =$ Average rate for all plant operations.

*This includes *all* employees in the building or structure to which the partial rate applies.

Selection of Code Number:

The classifier will find in this case that either of codes 4807, 4810, 4813 or 4816 as they each carry a rate of $4.97 which is the nearest rate to the average rate determined, $4.67 would meet the requirements. However, 4810 should be selected because that corresponds to the ordinate of the process involving the most employees. *The actual Code Number to be assigned will be* 4870 *which is* 60 *numbers higher than the one selected from the rate sheet.*

NOTE: The rates used in this example were those in effect in New York in 1929.

CHEMICAL RATING PLAN

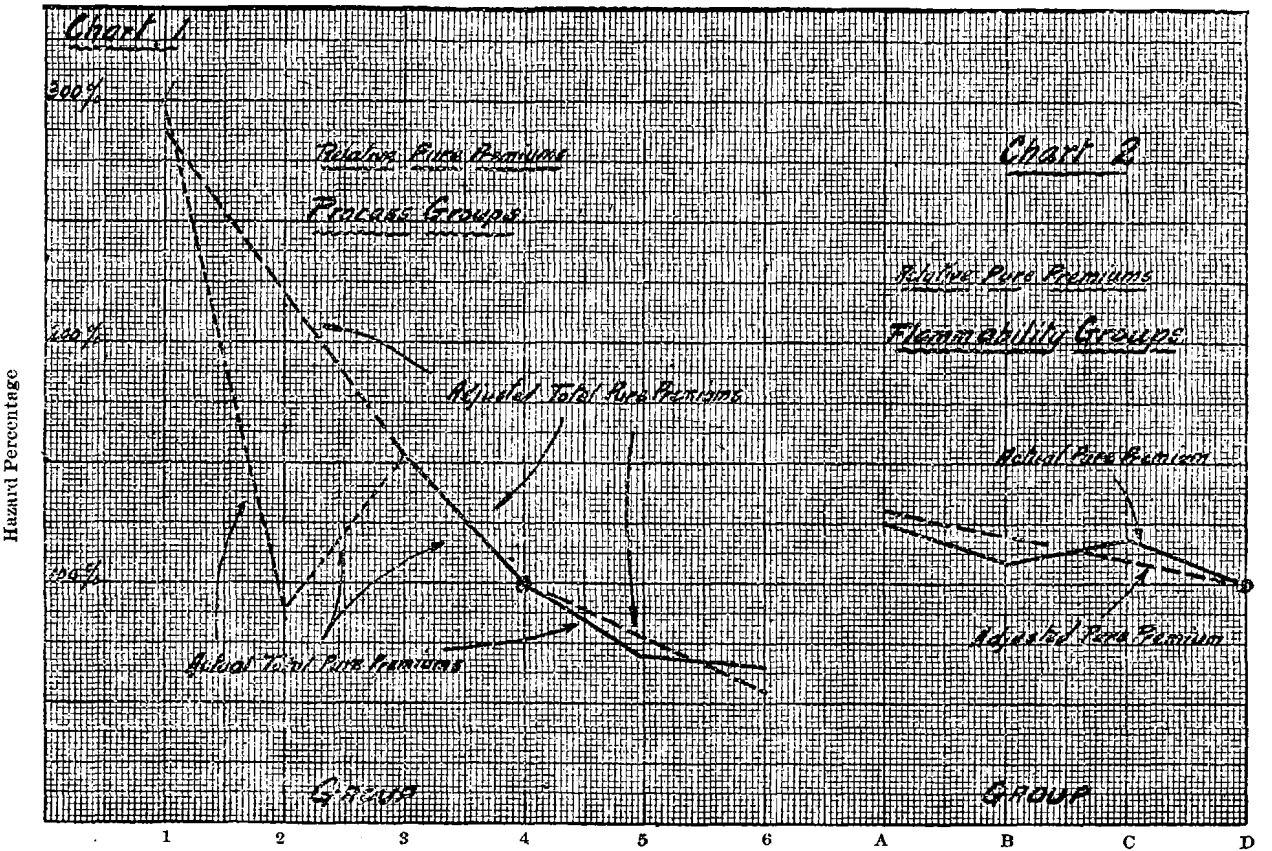

Chart 3 CHEMICAL RATING PLAN