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Laws vs. Regulations

Although a much-discussed topic, Federal regulation seems to be a little-understood one. A recent poll revealed that a large segment of the public is confused about how regulations differ from laws.

by Bruce P. Novak
Deputy Executive Secretary
Marine Safety Council

Last year the League of Women Voters Education Fund had the Gallup Organization conduct a nationwide poll to determine how well the public understood the subject of Federal regulation. The Fund wanted to discover, among other things, whether the public had any interest in learning more about how Federal regulations are made.

In a nutshell, the survey showed that most people have little or no awareness of what Federal regulations are, how they are made, or by whom they are made. If I may cite some of the figures:

- More than half of those surveyed could not name any difference between Federal regulations and Federal laws or said there is little or no difference between them. (Many of those who did answer this question thought that compliance with laws was mandatory but compliance with regulations was optional.)

- Nearly half said that Congress has responsibility for making regulations. Only 17% knew that the Executive Branch has the main responsibility in this area. Ten percent believed regulations were made by the courts.

- One-half of those interviewed could not name a single Federal regulation that affected them or their families.

- Despite their uncertainty about how regulations are made, however, most of those polled did not believe the myth that Federal regulations are made by bureaucrats working in isolation from the public. The majority thought that regulators worked with interested groups, Congress, and the general public.

- Fully two-thirds of those responding indicated that they had no idea how to go about influencing a decision made by an agency of the Executive Branch.

- Finally, over 60% expressed an interest in learning more about how the regulatory process works.

While I expect that *Proceedings* readers are more knowledgeable than the general public, many of you would probably be interested in learning more about the relationship between laws and regulations. (I had originally proposed an article on how the Coast Guard rulemaking process works, but the editor told me I'd written that one too many times before.)

Congress Makes the Laws

Congress enacts laws, generally to prevent or correct some problem. However, Congress does not directly implement or enforce these laws itself. That is the responsibility of executive agencies, which have the technical expertise, in the form of engineers, lawyers, and administrators, to draft the implementing regulations. Regulations set out in detail the nuts and bolts of requirements. Typically, such things as the quality and type of construction materials or the equipment options which will satisfy a requirement, the years and types of experience necessary for a license, or a host of other details are addressed in regulations. Most of these details are absolutely essential for the public to know in order to comply with the law, but they are not appropriate subject matter for the entire Congress to debate. Consequently, laws generally leave this sort of necessary implementing information up to executive agencies.

Another important aspect of every law is the penalty provision. While all laws are supposed to promote the general welfare of society, there is always a certain segment of society that will not feel compelled to obey the law for altruistic reasons alone. For this segment, there must be some threat of a penalty or other sanction for noncompliance. Most of you are probably familiar with the enforcement duties of Coast Guard marine inspectors. The inspectors board commercial vessels regularly to see if they are in violation of any regulations.

Laws, in other words, are—generally speaking—broad statements of national policy. The actual application of that policy to real-world situations falls to the executive agencies, who carry this out through specific regulations.

The degree of direction given to an agency in a law varies considerably, however. Some laws are far more specific than others. There are lots of reasons for this, and sometimes the specificity of the law depends on the prevailing philosophical mood of Congress. Many times, for example, Congress feels that it should defer to the expertise of the responsible agency and gives the agency only a broadly defined mandate. At other times Congress may feel that the agency cannot or will not do its job without specific instructions. Let me illustrate this point with a section from Title 46 of the United States Code. Section 481 has undergone some remarkable changes through the years. When the law was first enacted in 1871, it was very specific. It remained so through numerous revisions until 1959. Until that year it had provisions like these:

> A life buoy shall satisfy the following conditions:
> (a) It shall be of solid cork or any other equivalent material.
> (b) It shall be capable of supporting in fresh water for twenty-four hours at least thirty-one pounds of avoirdupois of iron.
>
> Life buoys filled with rushes, cork shavings, or granulated cork or any other loose granulated material or whose buoyancy depends upon air compartments which require it to be inflated are prohibited.
>
> . . . minimum numbers . . . which shall be provided . . . vessels under one hundred feet in length: minimum number of buoys, two . . .

and so on. As you can see, the law practically spells out each requirement.

In 1959 the law was amended to read:

> In order to provide against hazard to life and property, the Secretary . . . shall prescribe such rules and regulations as may be necessary for vessels subject to inspection and certification by the U.S.C.G. with respect to the following matters: (1) lifesaving equipment . . .

Quite a difference, isn't there? The current version notes the scope of the rules but doesn't set forth technical requirements.

Agencies Make the Rules

After an agency is given the authority or directed by Congress to regulate, it starts the rulemaking process. *Proceedings* readers are, of course, already familiar with this aspect of regulation, so I won't dwell on the mechanics of how the Coast Guard develops a rule and seeks public comment. What I do want to discuss, though, are some less obvious aspects of rulemaking. How, for example, does the agency select a guiding philosophy for any particular regulation? Each agency strikes a particular tone in relation to the public segment or segments it regulates. The Coast Guard has traditionally favored engineering solutions to problems. If there is a reasonable choice between an operational solution that would require a man to take a certain action and an engineering solution in which the potentially dangerous situation could be avoided by use of a special valve or electrical connection, the Coast Guard will opt for the engineering solution. This is not an unusual situation in safety-oriented agencies because the cost of human error can easily be injury or death. Although engineering solutions can be expensive in terms of money, they are less likely to fail than solutions that rely on human conduct.

There are no automatic answers where regulatory approaches are concerned, though. Some problems can be solved only by operational solutions. In some cases, engineering solutions are too expensive to require. These factors have to be weighed on a case-by-case basis.

Now let me look briefly at the decision each agency must make regarding the use of performance standards vs. specifications. The last two administrations have strongly supported the use of performance standards, sometimes called regulation by objective. Performance standards tell the regulated public what is expected in behavioral terms. A regulation might specify the stress loadings a line would have to withstand rather than dictate the line's composition and dimensions, for instance.

A major advantage of performance standards is that they allow for innovations in the regulated industry, and innovative solutions often have the effect of driving down costs over the long term. A specification, on the other hand, has the drawback of stifling new developments in industry, because it forces industry to use the equipment, material, system, etc., that is specified. There is little or no incentive for industry to find a better way to accomplish the regulation's objective; that would only require a massive effort to persuade an agency to change the regulation to accept the innovative solution.

On the surface, these are convincing arguments in favor of performance standards. Unfortunately, the real world does not always oblige policymakers by patterning itself according to the current trends in regulatory philosophy. There are many organizations that do not have research and development divisions and have no particular desire to invest in the research necessary to come up with original solutions to any particular regulation's objectives. Solutions which vary from company to company pose enforcement problems for the agency and, indeed, the companies, since they have to prove to the government that their proposed lines (to use our previous example) will actually be able to withstand stress under all the specified conditions. For many small companies who produce their wares from off-the-shelf components, the cook-book approach to regulations is better. If an agency's regulations spell out what will satisfy a requirement in terms of presently available material, anybody can put together a product he knows the enforcement branch of the agency will find acceptable. Obviously, an agency has to be conscientious in choosing a regulatory approach which balances the various drawbacks and advantages.

Another administration-supported regulatory philosophy is that of turning to voluntary standards wherever these are feasible. There is a regular alphabet soup of organizations which develop standards that the Coast Guard references in regulations. Some of the more common ones are the American Society of Mechanical Engineers (ASME), the American National Standards Institute (ANSI), Underwriters Laboratories (UL), the American Society for Testing and Materials (ASTM), and the National Fire Protection Association (NFPA). These organizations are typically made up of industry representatives, government people, and other interested parties. Together, they establish industry standards for materials, methods of construction, practices, and so on. Since these standards are in common use in the industry, the agencies can keep compliance costs down by using the accepted standards whenever possible.

Obviously, agencies must choose regulatory approaches on a case-by-case basis. To do this, the Coast Guard considers such things as the size and financial health of the regulated industry as well as the type of operation most businesses have. Our regulated industries are usually in close contact with us, and we are familiar with their needs and problems.

OMB Reviews All

There is one last check in the system. The Executive Branch retains review authority. All regulations must be reviewed by the Office of Management and Budget before they can be published in the Federal Register. It is at OMB that the regulatory philosophy is given a last look before the general public gets its chance to comment. OMB will object to regulations which, in its opinion, do not make the best use of the regulatory approaches available.

And that's it. Now the regulations come before the public, and the comment-and-revision process begins.

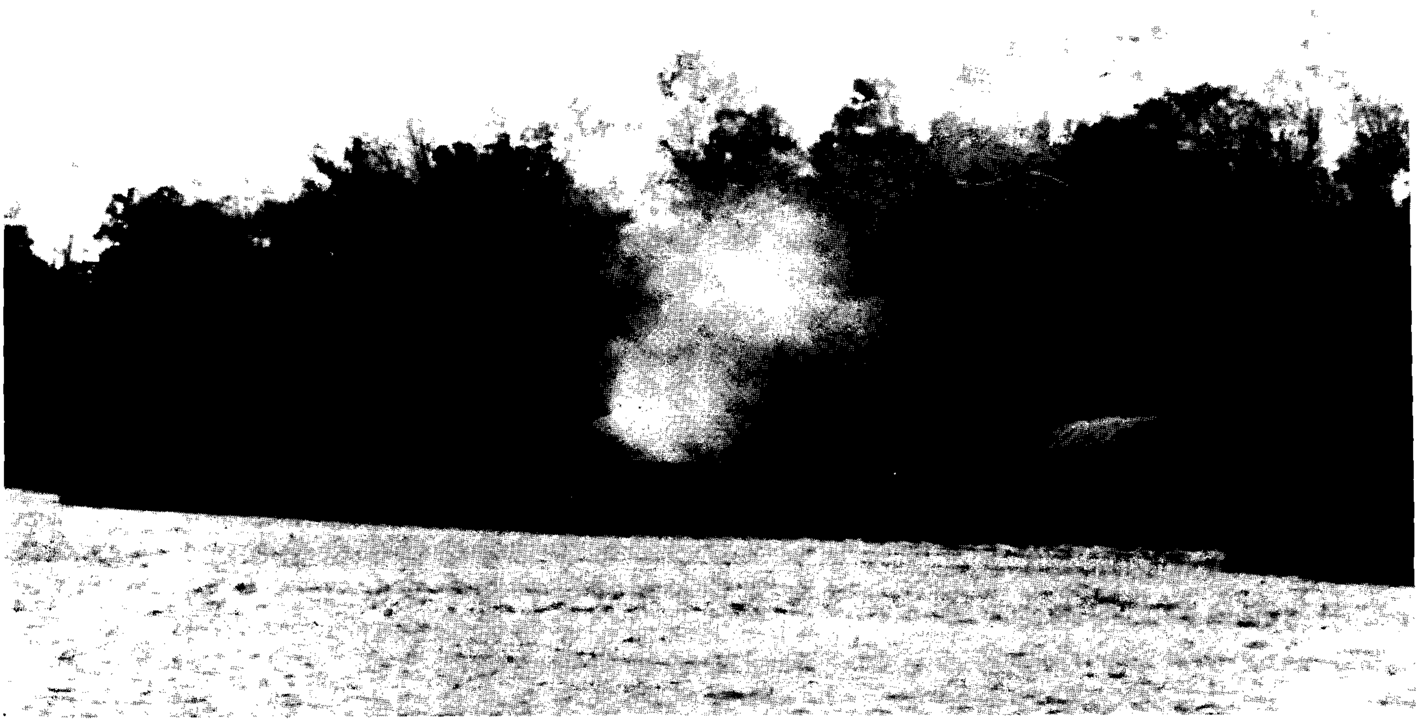
The regulatory system is designed to produce regulations that are appropriate to the regulated industry and achieve the goals of the legislation that prompted them. Admittedly, the road from a law to a rule is a long and often slow one, but it is purposely so: the long, slow road leads to more effective and more responsible regulations. ⚓

16 Tons: What do you get?

Another day older and a coal fire, perhaps

Depending on what kind of hold your vessel has, we may actually be talking about 20 or 25 tons of coal, rather than 16. Be forewarned: once certain types of coal reach a critical volume (many coal-yard operators never let a pile get more than three meters high), they begin to heat spontaneously. Granular solids like coal are poor conductors of heat, and if your coal cargo produces heat faster than it can be dissipated, you may end up with a full-scale fire on your hands.

by Mary M. Williams
Technical Advisor
Marine Technical and Hazardous Materials Division



The steam rising from its cargo of coal almost obscures this river barge. To the right are stacked barge covers. If they had been put properly in place rather than stacked, they might have kept water out of the coal and prevented it from heating.

All coal heats to some extent after it is mined. In most cases this does not present any problem. The coal heats up, and then it cools down. Some lower-grade coals are highly reactive, however. In times of energy shortages and a need for economy, it is easy to understand the urge to unload this "cheap" coal and take the chance that it will not heat excessively before its ultimate consumption.

Our concern about the spontaneous heating of coal stems from the fact there is no appropriate emergency response to excessive heating or the outbreak of a fire. The indiscriminate use of water may increase rather than decrease the heating.* The effectiveness of carbon dioxide in controlling coal fires has yet to be determined, but carbon dioxide has proved ineffective in some cases. Liquid nitrogen has been used on at least one occasion without conclusive results.

In an emergency, then, all a ship's master can do is head for the nearest port in the hope that it will have suitable unloading equipment, isolated pier space, and personnel to unload the cargo and cool it by aeration or water spray. This is not as simple as it sounds. Some piles of coal have been burning for years. To spread out a large quantity of coal to a thin layer to cool or be quenched with water takes quite a large area. Since the ideal emergency response procedure has yet to be devised, the best approach to the problem of coal heating and fires is prevention. Before we take a closer look at the

* To what extent water spray should be used on board ship is a judgment call at the specific time and place of the occurrence.

subject of spontaneous heating, let's look at the magnitude of the problem.

The History of Coal-heating Incidents

Spontaneous heating of coal is not a new problem. The history of coal fires on board ships begins with the carriage of coal on board ships.

As long ago as 1896, an investigative commission was appointed in New South Wales, Australia, to study what had become a serious problem on sailing ships.

The British did a similar study on steamships in 1929, finding 336 fires on 272 ships over a 3-year period. This period covered 20,000 sailings and the transport of over 160 million tons of coal.

The bulk of the fires studied in 1929 occurred in the bunkers of the steamships, and, in over half of the the fires reported, the heating of the coal to the temperature at which it ignites was assisted by direct heating from the boilers, steam pipes, etc. This was not a factor in the fires on board sailing ships, but it was a factor in one of the six most recent heating incidents.

Although the Coal Exporters Association reports that in the 3-year period 1978 - 1980 over 88 million tons of coal were transported without incident, there were enough incidents in 1981 to spur further studies. In 1981 there were coal fires involving the Indonesian ship KARTINI, the Liberian ship BALTIC NEPTUNE, the German ship WARSCHAU, the Panamanian ships GLOBAL MARITIME and WORLD DULCE, and a number of others.

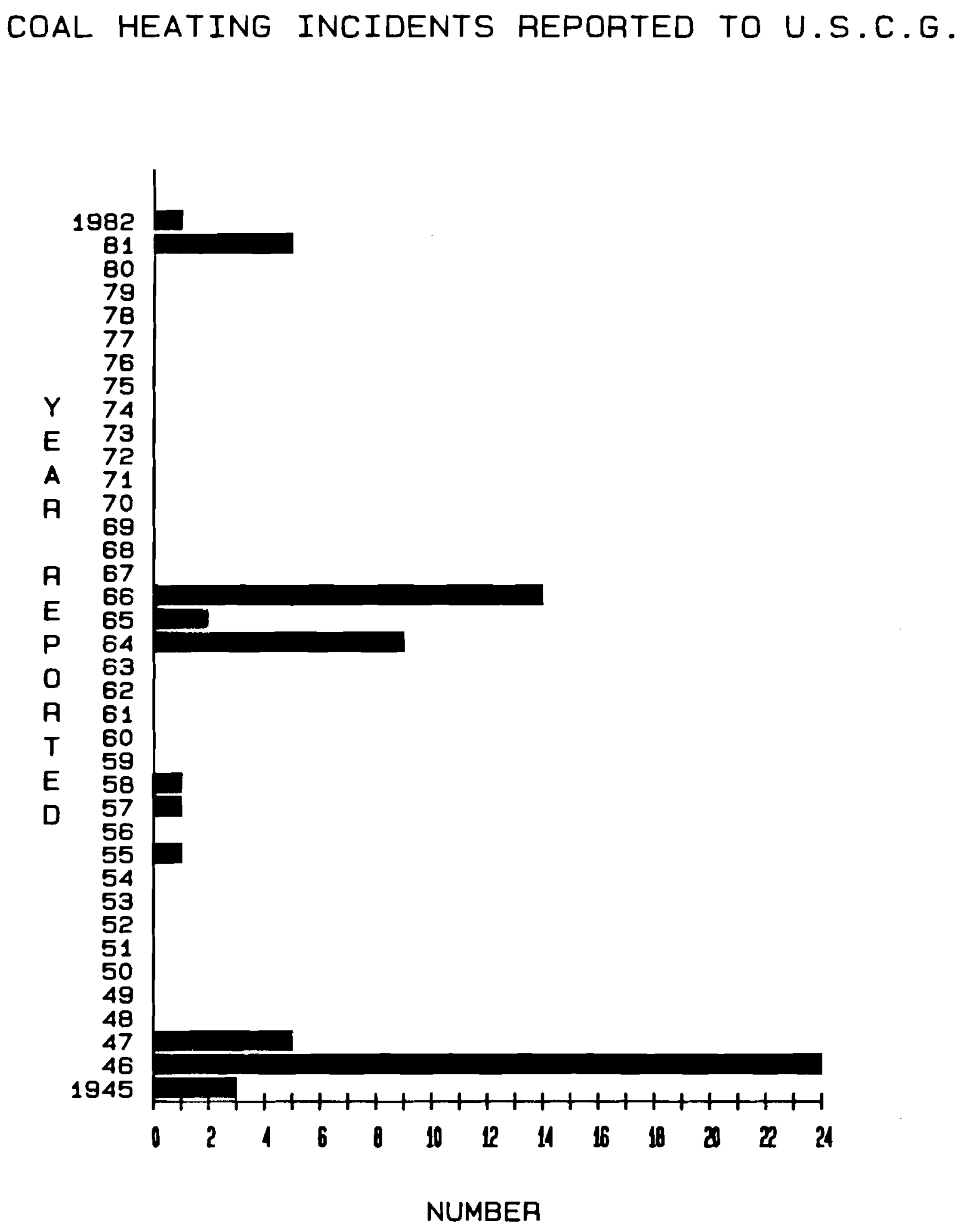
The last known ship incident in U.S. ports occurred in early April 1982 in the Port of Los Angeles/Long Beach. "Fine" (small-particle) coal from Orchard Valley, Colorado, was loaded onto the Liberian ship EASTERN CONFIDENCE. The coal had been on the dock since some time in December 1981 and was known to be heating in some spots. Temperatures as high as 300°F had been measured. This coal was loaded with a mechanical loader without regard for the temperature. A representative of a protection and indemnity organization measured the temperature in the No. 3 hold after loading and found temperatures of 135 -136°F. Under these conditions, insurance for the cargo was refused. Temperatures were measured every four hours for the next three days, showing no significant changes. The ship was unloaded. During the unloading operation, smoke (steam) was seen coming from the No. 5 hold. When the hatches were opened, glowing coal and some flames were noted in one area of the hold. The No. 5 hold was adjacent to the engine room, and a fuel tank containing fuel oil at a temperature of 190°F was located on the common bulkhead. The vessel was later reloaded with coal having temperatures less than 105°F, with care being taken to keep the cargo away from the engine room bulkhead. No further difficulty was noted during the EASTERN CONFIDENCE's voyage to Japan.

Although the data we have are not in question, we don't know that all incidents occurring in U.S. ports have been reported. Outside of some Great Lakes vessels, there are currently no American-flag ships carrying coal. Foreign-flag ships load at various American ports and sail for foreign ports. Our domestic involvement with coal comes with loading the ship or when a ship, with a cargo heating, requests refuge in one of our ports. (The coal on barges does heat and has been known to burn. To the best of our knowledge, this has presented no hazard to life or property.) A fire could start on a ship loaded at a foreign port, and the U.S. would encounter the ship only when it sought refuge in one of the U.S. ports. These are the only incidents that are officially reported to the U.S. Coast Guard. The total number of fires or heating incidents is thus unknown.

The Causes of Spontaneous Heating

Let us briefly examine the composition and structure of coal. Coal is formed from the long-term decomposition of vegetable (plant) matter under various conditions of temperature (the different seasons), humidity (rainfall and wind conditions), and pressure (altitude and the weight of the matter covering the vegetable matter). Considering the variety of plant life and the inevitability of contamination by animal, insect, and fowl wastes, it is not surprising that coal varies widely in composition. Mineral substances such as clay, sandstone, and pyrites (sulfur compounds) are also common contami-

Opposite page: judging from the incidents reported to the Coast Guard since 1945, coal fires and coal heating are apparently a cyclical phenomenon. When the demand for coal (energy) is high, the number of incidents increases. Currently, the demand for coal is at a 50-year low.



COAL HEATING INCIDENTS REPORTED TO U.S.C.G.
YEAR REPORTED
1982
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nants in coal deposits. Thus, coal may have almost any composition. Commercial grades, however, usually contain over 50 percent carbon by weight, and very high grades contain more than 95 percent carbon.

The basic reaction involved in coal heating is the oxidization of carbon by oxygen from the air. A carbon atom on the surface of newly mined coal will react with this oxygen, liberating energy in the form of heat. Newly mined coal will tend to heat on all newly exposed surfaces until the highly reactive forms of carbon are consumed. As stated earlier, in the majority of mined coal this results in no appreciable hazard. The coal heats up, a relatively inert or passive surface is formed, and the coal cools down to ambient temperature.

The water visible on the barge floor in the foreground of this photo may be what caused the coal to start burning. The coal to the left of the flames looks lighter because it has already been burned to ash.

The amount of highly reactive carbon on the surface of some lignites (low-grade, brownish-blackish coal), on the other hand, may be sufficient to heat the coal to an ignition temperature in a relatively short period of time. These forms of coal are generally stored under water to exclude air (oxygen) and prevent spontaneous ignition. Such forms of coal are consumed near the mine site or used for special purposes rather than released to the general commercial market.

Water is present in coal in two different forms. There is the so-called "free water," or water present as an external coating to the surface area of each piece of coal. There is also "bound water," water that is a part of the basic molecule or crystalline structure of the coal and which came from the vegetable matter from which the coal was formed. Free water is removed by any simple drying process. Bound water requires the addition of extra energy to break the water out of the coal structure. In terms of the total fuel value of the coal, water is a diluent, and thus a low water content is desirable. Coal from which the bound water is removed, however, is highly susceptible to spontaneous heating. Exposure of such coal to a highly humid atmosphere, rain, snow, fog, or any other source of water will result in heating as the lost water is replaced and form chemical bonds are reestablished. (The number of cargo fires attributed to the combination of high temperature and humidity existing during the monsoon season prompted protection and indemnity organizations early in this century to ban the shipment of coal from Calcutta during the summer months.)

Special Considerations for Ships

Since, with time, coal may gradually lose its bound water, all old coal must be cleaned out of a hold before reloading. Mixing any coal that has lost its bound water with coal having some free water can result in spontaneous heating. While this reaction itself may not be sufficient to increase the temperature of the cargo to any appreciably hazardous level, any increase in temperature will increase the reaction rate of other chemical reactions in the cargo (a rule of thumb is that for every 10°C increase in temperature, the reaction rate will double). Reactions that have reached an equilibrium state at 20°C may become unstable at higher temperatures; thus, the small amount of heating resulting from the reconstitution of bound water may trigger reactions that will ultimately result in a full-scale fire.

Coal is purchased to meet nominal specifications for various components of its composition. Many times these specifications are met by averaging the chemical composition of two or more types of coal. If these different grades are not blended to present a relatively homogeneous mixture, spot heating may occur as free moisture is transferred from one source to become bound water in another source of coal. It is for this reason that layering of different types of coal or even of the same types of coal that may have had a different storage and handling history is not recommended.

Sulfur contamination is another possible source of spontaneous heating. Bacterial action may oxidize the sulfur to sulfur dioxide; subsequent reactions would turn this into sulfurous and sulfuric acids. Reaction of water with certain iron pyrites (iron sulfides) can also result in the formation of sulfuric acid and the liberation of heat. The reaction of these acids with steel can be severe (one vessel carrying high-sulfur coal reported what, computed on an annual basis, would have been a corrosion rate in excess of 11 inches per year). In addition to posing risks to a vessel's integrity, the acid/steel reaction generates potentially explosive hydrogen.

Assessing the Hazard

According to the British report done in 1929, the general cause of spontaneous combustion of coal was a combination of chemical and physical factors. The contributing chemical factors were the type of coal and its pyrite content. The physical factors were the size of the coal particles, the temperature, and the accessibility of oxygen. Moisture content is a factor that fits into both categories. Other contributing factors included direct heating, air leakage or ventilation, and incomplete removal of coal from previous voyages. We have no reason to believe that any appreciably different factors need to be considered today.

In the attempt to prevent coal fires, our first concern is determining the degree of hazard.

Measuring temperature seems the obvious way to do this. At what particular temperature, however, should serious concern be given to the heating and some preventive measures taken to mitigate the hazard? Further study points to the *rate* of temperature rise as a more significant indicator. The question then becomes: at what rate of temperature rise should one take action to prevent continued heating of the cargo? Is this a function of distance from a port of refuge? How do you know which ports are suitable to serve as ports of refuge?

Assuming we arrive at a consensus on what temperature or rate of temperature increase is critical, we have to decide *how* we are going to measure cargo temperature. Temperature probes may seem a logical response, but how, where, and by whom will these probes be placed? It is difficult to imagine a permanent installation that would not interfere with the loading and unloading operation. Specialized labor is required if the temperature-sensing devices are placed during or after the loading operation. If continuous reading is not used, how frequently should temperature readings be taken? All of this adds to the cost of shipment. A cost/benefit analysis at the "gut feeling" level suggests that other possibilities be considered.

Ann Kim, who did an extensive survey of the literature on spontaneous heating of coal for the Bureau of Mines in 1977 (Information Circular 8756), concluded that there was no simple, reliable, and objective method of evaluating a coal's potential for spontaneous heating. "Rank" and changes in moisture content seemed to be the most important factors. (A coal's "rank" is a function of its carbon content and heating value.)

Regulation

Since not all coal is subject to spontaneous heating or the generation of dangerous quantities of hazardous gases, any regulatory restriction applied to promote the safe transport of coal should be limited to that portion of the coal industry where a potential hazard exists. Regulation of all coal in transportation is unnecessary if we can identify those forms of coal that present potential hazards. Talk of such identification has already met with resistance from the coal industry. Shipments of these forms of coal would be subject to additional charges and could not compete economically with less hazardous coal shipments. Some additional costs probably would accrue to the mine operator or initial shipper in increased insurance rates as damage claims were met by the insurers.

Eventually, some economic adjustment must be made between the seller and buyer of coal that has been subjected to heating. The buyer is purchasing energy, normally specified in the purchase agreement as so many BTUs. Spontaneous heating and/or combustion results in an energy loss and thus represents a loss to the buyer. It is possible that eventually the problem of spontaneous heating will be solved on the basis of economics in the marketplace. However, as long as BTUs are at a premium, the type of coal that lends itself to spontaneous heating will continue to be sold.

U.S. regulation of coal in transportation has been minimal and has applied only to packaged shipments of ground bituminous coal, sea coal, and coal facings, as specified in Title 49 of the Code of Federal Regulations. These forms of coal are specifically identified as a "hazardous material" in 49 CFR. Title 49's general definition of "flammable solid" includes all spontaneously combustible material, however.

Since Title 49 applies to packaged hazardous materials, it does not cover bulk shipments of coal. The Ports and Waterways Safety Act, as amended in 1978, however, includes in its definition of "hazardous material" any material designated as a hazardous material under the Hazardous Material Transportation Act. Thus a "hazardous material" under 49 CFR is also a "hazardous material" under 46 CFR, which governs the marine transport of coal in bulk. Up to the present time, however, there have been no requirements or restrictions regarding bulk shipment of coal.

Since coal heating and fires on board ships carrying coal are an international problem, they are correctly addressed at the international level. Heating is currently under review by the International Maritime Organization, which may recommend some special handling and stowage conditions for the more hazardous forms of coal.

P & I Club Restrictions

As a result of recent coal-fire incidents, the protection and indemnity organizations concerned with marine shipping (generally referred to as the "P & I Clubs") have been generally restricting any loading of coal ships with coal at temperatures exceeding 105°F. The printed instructions issued by the Standard Steamship Owners' Protection and Indemnity Association (Bermuda) Limited in March 1982 (Circular No. 1982/2) read as follows:

Carriage of Coal
From U.S. Gulf Ports

Members will be aware of the considerable growth in the export of Coal from the U.S.A. and, in particular, from the U.S. Gulf Ports. Ships have experienced difficulties with coal from U.S. Gulf Ports where serious heating of the cargo has occurred at the time of shipment and, in some cases, serious heating has taken place on the voyage, necessitating the discharge of cargo at a port of refuge. It is, therefore, suggested that where possible Members should obtain details of the cargo to be shipped to establish in consultation with the shipper that the cargo is safe for carriage. If necessary, the Association's Correspondents can be asked to appoint surveyors on behalf of the Member to establish whether or not the coal to be loaded is either heating or contains temperatures in excess of 105°F. If the Cargo is found to be heating or has temperatures above 105°F then further expert guidance should be sought prior to loading.

Potential problems in the carriage of this cargo may be avoided by adhering to the following suggestions:

1. The Master should ensure that openings which provide ventilation to the

The "valley" between two "peaks" of coal has already turned to ash in this steaming pile. Had the pile been trimmed, or leveled off, the coal might never have started heating.

lower parts of the cargo spaces are blanked off before loading commences.

2. Prior to loading, the bilge pump system should be checked and the bilge wells examined to confirm that they are free of water and waste materials.

3. During loading, the Master should ensure that the cargo is not stowed adjacent to hot areas.

4. At the completion of loading, the cargo should be trimmed as level as is reasonably practicable to facilitate surface ventilation for the dispersal of dangerous gases that may be produced and to reduce the risk of the cargo shifting during the voyage.

5. On the completion of loading, the ship's bilges should be pumped dry and a sample of the bilge water retained on board. On completion of discharge, the holds and bilge lines should be inspected and if abnormal corrosion is present a surveyor should be called in immediately.

6. Should the Master have reason to suspect that heating or spontaneous combustion is occurring during the voyage he should:

   (A) Ensure that the cargo compartment in which over-heating is suspected is completely closed until the intended port of discharge or, if necessary, a port of refuge is reached.

   (B) Apply Carbon Dioxide, inert gas or high expansion foam into the hold, if any of these are available; water or steam, however, should not be applied directly to burning coal.

   (C) If necessary, use water to cool the boundaries of adjacent cargo spaces.

   (D) Obtain expert advice.

7. The attention of Members is drawn to the recommendations given in Appendix B of the IMO Code of Safe Practice for Solid Bulk Cargoes (1980 Edition) and any further amendments thereto and, where appropriate, the British Merchant

Shipping Notices Nos. M970, M971, and M972.

Answers

The Bureau of Mines has studied the hazard characteristics of coal for many years and has not as yet arrived at any limiting conditions for prevention of spontaneous heating or for extinguishment of major coal fires.

Moisture content, one of the two factors pinpointed by Ann Kim in her Bureau of Mines study, is not really controllable. Trucks, rail cars, and barges carry coal uncovered. Storage piles are outdoors, uncovered. Some coal may be pumped onto barges in the form of a water-coal slurry. The Occupational Safety and Health Administration requires the use of water sprays to reduce the dust hazard at most coal transfer locations.

Other factors contributing to spontaneous combustion, such as particle size, aeration, and ventilation are interrelated. Void space and angle of repose of the coal pile are functions of particle size and particle distribution. The void space gives you a measure of the amount of entrapped air which could start a reaction, and the angle of repose gives a measure of the size of the chimney (the peak in the pile drawing air upward) through which reaction gases will flow. Sealing the hold to eliminate the addition of air is not necessarily effective in reducing the hazard of flammability. Many forms of coal generate methane gas. Some generate carbon monoxide. A collection of these gases in an enclosed space presents a flammable explosive hazard. Also, as discussed earlier, the corrosion reaction caused by the sulfuric acid from high-sulfur coal can produce explosive hydrogen. The potential generation of these hazardous gases suggests that the holds be well ventilated in spite of the fact that this will promote spontaneous combustion.

Several groups have formed to look into improving temperature measurement techniques and the effects of such simple operating changes as covering the barge and trimming, or smoothing out, the load. A recent review of safety practices in the marine transport of coal, and indeed all bulk solids, showed a need for suitable cargo temperature-measuring devices as well as special gas-analysis equipment. Testing of the composition of the atmosphere above the cargo in a hold should become a routine operation. If the composition shows any appreciable changes over time, the analysis should be repeated at regular intervals and expert advice sought as to the severity of the hazard involved. In the case of coal, the analysis should be performed not just for oxygen content and flammability, but also for methane, hydrogen, carbon monoxide, hydrogen sulfide, and sulfur dioxide. (In a low-sulfur coal, the testing for hydrogen sulfide and sulfur dioxide would be omitted.) As is the case with temperature measurement, it is not the actual concentration of any one gas component that is a critical factor in the analysis of the chemical reactions taking place, it is the rate of change of the composition that is critical.

What temperature in the hold presents a real threat of structural damage to the ship? The temperature of the cargo, since it will be far from uniform, is perhaps meaningless. Perhaps it is only the temperatures of the bulkheads of the cargo spaces that need to be monitored. These temperatures, combined with a knowledge of any changes in composition of the atmosphere in the holds, will suffice to establish the degree of hazard (risk) entailed in continuing a voyage.

The problems leading to coal fires affect only a small percentage of coal shipments, and it is important to avoid penalizing all shippers for the problems connected with a few shipments. The nation's economy does not need restriction of the export of coal at this time, and any undue regulation that will restrict trade should be avoided. However, it is important to establish the degree of risk that is considered "acceptable."

The current lull in the outbreak of coal fires aboard ships can perhaps be attributed in part to the P & I Clubs' surveillance of the cargo during the loading operation and before sailing. The state of the world economy and the recent drop in energy requirements and consequent decrease in the demand for coal undoubtedly contribute to the reduced occurrence of coal fires at this time as well.

As deeper channels are dug, however, and as shippers turn to loading and unloading their vessels offshore through a lightering operation, the size of vessels carrying coal will increase. The economics of coal transport dictate that the largest ships possible be used, but if cargo holds become proportionally larger, the critical volume of coal at which spontaneous heating begins may be reached more and more often. Since this could lead to another upsurge in the outbreak of coal fires, it is important that we now consider actions that could prevent such a recurrence. ⚓

Keynotes

The Coast Guard published the following items of general interest in the Federal Register between May 19, 1983, and June 9, 1983:

Final rules:

CGD 2-83-02	Memphis Cotton Carnival River Pageant; Regulated Area, Mile 730.0 to 740.0 (Published May 19)
CGD 81-067	Chesapeake Bay and Tributaries, Maryland; Regulated Navigation Area (May 19)
CGD 11-34-83	Establishment of a special regulated area on the Colorado River for Coors Memorable Memorial Day (May 19)
CCGD3-82-31	Anchorage Grounds; Delaware Bay and River (May 26)
CCGD3-83-14	Safety Zone Regulations; New Jersey, New York Harbor, Newark Bay (May 26)
COTP LA/LB 83-04	Safety Zone Regulations; San Pedro Bay, California (emergency rule, May 26)
CGD 09-83-13	Special Local Regulations; Lake St. Clair Offshore Racing Association Down-river Offshore Classic (Detroit River) (June 9)
CGD 09-83-08	Special Local Regulations; International Freedom Festival Air and Water Show (Detroit River) (June 9)
CGD 09-83-10	Special Local Regulations; Duluth Harbor Fireworks (June 9)
CGD1 83-01	Marine Parade; Great Kennebec River Whatever Race (Maine) (June 9)
CGD08-83-01	Drawbridge Operation Regulations; Bayou Chico, Florida (June 9)

Proposed rules and notices of proposed rulemaking (NPRMs):

CGD13-83-10	Regatta, Columbian Cup Unlimited Hydroplane Race; Proposed Establishment of Controlled Navigation Area (Columbia River, Washington State) (May 19)
CGD 82-103	Change in Interpretation of Section 2 of the Shipping Act, 1916, as Amended, for Coastwise Trading Purposes (notice of withdrawal of advance notice of proposed rulemaking, May 19)
CGD 83-011	Interpretive Rule for Inland Navigation Rules (guidance for defining "composite units") (May 26)
CGD3-83-13	Marine Parade, Night in Venice, Great Egg Harbor Bay, Ocean City, New Jersey (May 26)
CGD 08-83-02	Drawbridge Operation Regulations; Louisiana (June 9)
CGD 82-004	Offshore Supply Vessel Regulations; Extension of Comment Period until September 12, 1983 (June 9)

Questions concerning regulatory dockets or comments on the items described below should be directed to the Marine Safety Council at the following address:

Commandant (G-CMC)
U.S. Coast Guard
Washington, DC 20593
Tel.: (202) 426-1477

* * *

Amendments Proposed for Navigation Regulations for Lake Huron/Lake Erie Connecting Waters (CGD 78-151)

On June 6, 1983, the Coast Guard published an NPRM proposing changes in the inland waterways navigation regulations for the connecting waters from Lake Huron to Lake Erie. The purpose of this action would be to modernize and simplify the requirements found in the regulations and make them compatible with the requirements of the Canadian Coast Guard in effect in the Canadian portion of the waterway.

Comments on the proposal should be submitted to the Marine Safety Council by September 6.

Safety Zone Created in Mississippi River Gulf Outlet (CGD8-81-801)

On May 31, 1983, the Coast Guard published a final rule creating a safety zone between the seaward entrance and LT 62 of the Mississippi River Gulf Outlet. As the number and size of vessels using the outlet, the Michoud Canal, and the Inner Harbor Navigation Canal increase, so does the need to minimize the possibility of collisions and the environmental and economic harm they would cause the Port of New Orleans. This rule will coordinate vessel movement.

The rule became effective July 1.

Second NPRM Issued on Drawbridge Regulations (CGD 82-025)

The Coast Guard published an NPRM in the July 12, 1982, Federal Register revising its regulations for drawbridges across the navigable waters of the United States. Since many changes were made in the proposal in response to the comments received, the Coast Guard issued a supplementary NPRM on May 31, 1983. The proposed revision is intended to improve the organization and clarity of the initial proposal and make the regulations easier to follow for drawbridge owners, drawtenders, boaters, and other interested parties.

Actions of the Marine Safety Council

No further action on work plans was approved by the Marine Safety Council during the month of June.

Radioactive Materials Regulations Changed (HM-169)

The March 10, 1983, edition of the Federal Register contains the revised Requirements for Transportation of Radioactive Materials. This final rule makes the Hazardous Materials Regulations (Title 49 of the Code of Federal Regulations) compatible with International Atomic Energy Agency (IAEA) Regulations for the Safe Transport of Radioactive Materials, Safety Series No. 6.

The substantive changes are as follows:

1) The seven transport groups have been eliminated. Each radionuclide has been given two values. Maximum number of curies permitted in Type A packages in special form is Value A_1 and in normal form is Value A_2.

2) The qualifying tests for Special Form Radioactive Materials have been modified. A bending test has been added, more detailed instructions for certain procedures have been provided, and the maximum loss allowed has been changed.

3) Lead-201 has been added to the table of radionuclides.

4) The metric system has been employed to the extent practicable. Some conventional units of measurement have been retained in lieu of little-used S.I. units (the regulations continue to speak of "millirems," for example, rather than "Sieverts").

5) IAEA Empty Packaging criteria limiting levels of removable internal and external contami-

nation and radiation have been adopted.

6) Import/export shipments of radioactive material packages that conform to the IAEA regulations are permitted.

7) The designation of "Highway Route Controlled Quantity" based on the A_1/A_2 system replaces "large quantity" criteria.

8) The limit of 200 Transport Indexes per vessel is removed for packages stowed in freight containers.

Single copies of this Federal Register item are available from the Information Services Division, DMT-11, Materials Transportation Bureau, Department of Transportation, Washington, DC 20590.

Pollution Liability Functions Change Hands

Since May 5, 1983, functions relating to the financial responsibility of vessels for pollution liability have no longer come under Federal Maritime Commission jurisdiction. On that date, the President signed an Executive Order directing the transfer of those functions to the Secretary of the Department in which the Coast Guard is operating.

The Secretary of Transportation (under whose jurisdiction the Coast Guard operates in peacetime) has indicated that he will delegate the functions to the Commandant of the Coast Guard.

The Coast Guard is creating a new division within its Office of Marine Environment and Systems to take on the transferred functions. Nineteen people will move from the Federal Maritime Commission to the Coast Guard as the program changes hands.

Also being transferred are the program-governing regulations concerning demonstration of ability to meet pollution liability resulting from spills of oil and other hazardous substances. Under the Federal Maritime Commission, those regulations were found in Parts 542, 543, and 544 of Title 46 of the Code of Federal Regulations. A forthcoming Federal Register notice will redesignate those regulations Parts of an appropriate Coast Guard chapter of the Code of Federal Regulations. No substantive changes are planned, but Coast Guard nomenclature will be substituted for references to the Federal Maritime Commission where applicable.

The changeover is scheduled to be completed by the end of this fiscal year.

Further details regarding the transfer of functions will be included in the Federal Register notice. ⚓

Pointers for improving USMER messages

Until the previously announced merger between the USMER and AMVER systems takes place, the Maritime Administration will continue to monitor USMER messages and point out areas in which instructions are not being followed or where improvements could be made. Three such areas have been noted:

(1) Many USMER message drafters have added "INFO AMVER" as an addressee or the phrase "NOTIFY AMVER" or "PASS TO AMVER" on the remarks (RMK) line. Users are asked not to use such additional instructions in the message, since USMER traffic is automatically routed to the AMVER CENTER-NEW YORK through the use of the AIG 388 or 7650.

(2) Users are asked to always include the call letters of the commercial radio station(s) guarded as the first item in the remarks (RMK) line. This information would facilitate communication with an individual ship should an emergency or other need arise.

(3) USMER instructions indicate that when a vessel calls at various U.S. ports during the coastwise leg of a foreign voyage, a list of the expected ports of call should be given in the remarks section of the arrival report at the first U.S. port. This itinerary is often omitted. Alternatively, arrival and departure reports could continue to be sent, which would benefit the AMVER plot. Users are asked to always follow one or the other of these procedures.

These instructions will be superseded by Coast Guard instructions issued when the merger takes place and the use of AMVER becomes mandatory. ⚓

STCW Convention to Enter into Force in April 1984

The ratification by Poland of the International Convention on Standards of Training, Certification and Watchkeeping for Seafarers, 1978 (STCW) has set in motion the coming into force of a treaty which has been the product of over a decade of hard work. International Maritime Organization Secretary-General C. P. Srivastava announced the 25th signatory to the convention on April 28. The treaty itself is scheduled to come into force one year from that date.

The STCW Convention establishes improved international requirements for training, certification, and watchkeeping for masters, officers, and certain crew members of seagoing merchant ships. The purpose of these requirements is to provide more highly qualified personnel on board ship, thereby reducing marine casualties, promoting safety of life at sea, and protecting the environment. To come into force internationally, the treaty must be ratified by at least 25 nations representing at least 50 percent of the world's tonnage. These requirements were reached as Poland numbered itself 25 on the list of ratifiers, bringing the tonnage percentage to over 65 percent of the world's merchant fleet.

To date, the STCW Convention has yet to be ratified by the United States. It was transmitted to the Senate in August 1979 by President Carter with the recommendation that the Senate give its advice and consent. Whether ratified by the U.S. or not, the STCW Convention will come into force internationally on April 28, 1984, with the result that U.S. vessels calling at foreign ports which are signatory to the convention will be required to comply with the treaty's provisions.

(Reprinted from the May 23, 1983, Activities Letter *of the American Institute of Merchant Shipping)*

Inert Gas System Requirements Now in Effect

Inert gas system requirements have been established by Congress (through the Port and Tanker Safety Act of 1978), the U.S. Coast Guard, and the International Maritime Organization. Effective June 1, 1983, all product carriers above 40,000 DWT and all crude carriers above 20,000 DWT must have and use an inert gas system (IGS). Title 46, Code of Federal Regulations, 32.53, contains the IGS requirements.

Inert gas systems provide an increased measure of safety for tankships, and, for that reason, the Coast Guard will enforce the requirements rigorously. Any vessel that is required to have an inert gas system on June 1, 1983, but does not have such a system will be subject to civil and criminal penalties under the Port and Tanker Safety Act of 1978. This applies to both U.S.- and foreign-flag vessels.

To trade in U.S. waters, foreign-flag tank vessels must comply with 46 CFR 32.53. Exemptions from the IGS requirements are issued by Commandant (G-MTH). An exemption by a foreign vessel's flag state does not exempt the vessel from the appropriate U.S. Coast Guard IGS requirements. The vessel's owner must request an exemption from Commandant (G-MTH), U.S. Coast Guard, Washington, DC 20593.

EUROSHIP 83 Scheduled

EUROSHIP 83, a conference on future maritime policy with particular reference to Europe, has been scheduled for December 4 - 6, 1983, in Monaco. The conference is being sponsored by the Institute of Marine Engineers, London, in association with the Transport Division of the Commission of European Communities.

Among the subjects discussed at the conference will be European Economic Community policy, shipping trends, shipbuilding with the accent on the design of safe, economic vessels, and port design. An International Maritime Organization representative will speak on improvements in safety, specifically, crew training and certificates, monitoring IMO Convention provisions, principles of safe manning, anti-pollution measures, projects likely to be completed in the 1990s, and future requirements.

Further details on the conference are available from Mr. H. Williams, EUROSHIP 83, The Institute of Marine Engineers, 76 Mark Lane, London EC3R 7JN, England. ⚓

Hydrochloric Acid: HCl

Synonyms:	muriatic acid chlorohydric acid
Physical Properties	
boiling point:	110°C (230°F)*
freezing point:	-42°C (-44°F) to -74°C (-101°F), depending on concentration
vapor pressure** at	
20°C (68°F):	212 mm Hg
46°C (115°F):	543 mm Hg
Threshold Limit Values (TLV)	
Time Weighted Average: (for the gas hydrogen chloride)	5 ppm; 7 mg/m^3
Flammability Limits in Air	
Hydrochloric acid is nonflammable.	
Combustion Properties	
Hydrochloric acid is noncombustible.	
Densities	
liquid (water = 1.0):	1.14 to 1.19, depending on concentration
vapor (air = 1.0):	1.26
Identifiers	
U.N. Number:	1789
CHRIS Code:	HCL
Cargo Compatibility Group:	1 (Non-oxidizing Mineral Acids)

This is the fourth in a series of five Chemicals of the Month written by guest authors--chemistry students at the Coast Guard Academy in New London, Connecticut.

Hydrochloric acid exists naturally in such varied places as the emissions from volcanoes and the gastric juice in mammals' stomachs. It is also a widely used product in industry, where its applications range from use in the metal refining process to use in the preparation of such food products as sugar, monosodium glutamate, and gelatin, to name only a few.

Knowledge of the existence of hydrochloric acid dates back to the beginning of the Christian era, when it was generated as an impurity in the experiments conducted by alchemists. Johann Glauber, a German chemist, was the first (in 1648) to produce hydrochloric acid by setting up a reaction between sulfuric acid and table salt. (His interest actually lay in another product of the reaction, sodium sulfate, a mild laxative whose common name is still "Glauber's salt.")

Hydrochloric acid is simply a gas, hydrogen chloride, dissolved in water. This gas is colorless or slightly yellow and has a sharp, irritating odor. The British-born chemist Joseph Priestly collected gaseous hydrogen chloride produced by sea salt in the 18th century, naming it "marine acid air."

Hydrochloric acid is produced today in a variety of ways. First, there is Glauber's method, a simple reaction of sulfuric acid on common salt. "Gaseous hydrochloric acid" (anhydrous hydrogen chloride, a form containing no water) is produced by burning chlorine in hydrogen. Finally, hydrochloric acid is produced as a by-product when chlorinated hydrocarbons (chloroform, trichloroethanes, etc.) are synthesized.

There are several grades, or concentrations, of hydrochloric acid. The pure reagent ("fuming") grade used by chemists contains approximately 37% hydrogen chloride and is a clear, water-

* The boiling point varies according to the concentration of the solution. Once a solution has boiled down to the point where it contains approximately 20% hydrochloric acid by weight, the boiling point remains constant at this temperature.

** for a 37% solution

white solution. Grades with lower percentages (35%, 31½%, 28%) are generally slightly yellow because they contain dissolved impurities such as iron. (Mariners would be more likely to see the acid labeled in terms of Baumé numbers, numbers from a scale of the specific gravities of liquids developed by the French chemist Antoine Baumé in about 1800. The corresponding figures on this scale would be 23° Bé and 22, 20, and 18° Bé, respectively.)

Hydrochloric acid reacts with many metals, such as tin, zinc, iron, aluminum, and magnesium, to produce hydrogen; this may form an explosive combination when mixed with air. Also, the combination of hydrochloric acid with alkalis such as caustic soda (also known as sodium hydroxide) will result in the generation of large amounts of heat.

With its corrosive properties, hydrochloric acid is a very dangerous chemical if it comes in contact with man. Concentrated solutions of the chemical cause severe burns to any exposed area of the body. Exposed skin areas should be promptly washed off, and the eyes, if affected, should be immediately flushed with generous amounts of water. This type of exposure is not its only danger, however; inhalation of gaseous hydrochloric acid (anhydrous hydrogen chloride) in high concentrations causes pulmonary edema (filling of the lungs with fluid) in a short period of time. Because the vapor has such a sharp odor, a victim is not likely to inhale seriously toxic quantities unless he is trapped. Anyone working with hydrochloric acid should be outfitted in the proper protective gear. This includes an acid suit, rubber boots, rubber gloves, and cup-type goggles and/or a full-face shield. A self-contained breathing apparatus should be readily available.

The hazards connected with carrying hydrochloric acid in bulk form are equally serious. As stated earlier, the reaction of hydrochloric acid with certain metals can generate an explosive mixture of hydrogen in air. This reaction will occur if the acid comes in contact with the metal tank in which it is being transported. For that reason, regulations require that bulk tanks be lined with rubber if they are to carry hydrochloric acid. Also, the tanks must be independent of the vessel so that they will not be affected by the stresses that play on the ship.

In the case of a hydrochloric spill on land, there are a number of precautions that should be taken. All people should be kept away from the spill area to prevent any injury. If hydrochloric acid fumes become concentrated around the spill area, they can be knocked down with water vapor from a fire hose. If a tank of hydrochloric acid is in a fire, it should be cooled with water. (Although it is noncombustible, hydrochloric acid could cause a tank to explode from intensified internal pressure.) Once a spill has been contained, the contaminated area must be cleaned up. This can be accomplished by spreading a lime-soda ash mixture and soaking the area with water. This "mud" neutralizes the acidity and can be shoveled into a truck and hauled away.

Whether the spill is on land or at sea, the incident should be reported to the National Response Center as soon as possible. Professionals will be sent to the scene to aid in the containment and clean-up of the spill. The Center's toll-free number is 1-800-424-8802.

Hydrochloric acid is regulated by the U.S. Coast Guard as a Subchapter O cargo for both tankships and tank barges. The U.S. Department of Transportation classifies it as a corrosive material, and the International Maritime Organization includes it in Chapter 6 of its Chemical Code (chemicals to which the Code applies). Hydrochloric acid can be found on page 8102 of the International Maritime Dangerous Goods (IMDG) Code, and it is assigned a Hazard Class of 8 (corrosives).

Matt Fries was a third-class Cadet at the Coast Guard Academy when he wrote this article for a class on hazardous materials transportation taught by LCDR Thomas J. Haas. Technical assistance was provided by personnel in the Cargo and Hazards Branch at Coast Guard Headquarters.

Cargo Shifting

The list that developed when grain shifted in the SS PILGRIM's holds nearly led to the vessel's loss.

On September 23, 1979, the SS PILGRIM departed Port Arthur, Texas, with a cargo of 12,478 tons of grain for discharge in Durban, South Africa. This was scheduled to be the PILGRIM's last trip, for after discharging the grain the vessel was to proceed to Taiwan for scrapping. As events unfolded, however, the voyage almost ended prematurely off the coast of Africa with near-tragic consequences for the crew.

With the exception of a detour to Tampa, Florida, for repairs to the engineering plant, the voyage to Durban proceeded routinely until the morning of October 18, when a series of unsettling events began. On that morning, the vessel was hove to in high winds and rough seas while the crew secured a cargo boom which had broken free. When the vessel resumed course, a 4^{o} port list was detected. The ship's officers suspected a cargo shift as the cause of the list. Later that same day, water began accumulating in an athwartship passageway as well as in other below-deck spaces. Water could be seen entering around the port side-port door, the garbage chute, and through below-deck drains which penetrated the hull. As the vessel rolled routinely 5^{o} starboard to 45^{o} port, the cargo continued to shift and the vessel continued to take in water.

On October 19, with the PILGRIM listing and laboring in deep swells, the master directed that a distress signal be transmitted. A salvage tug arrived on scene the following day and transferred portable pumps to the vessel. Two days later, the PILGRIM, listing 17^{o} to port, entered Capetown, South Africa, under its own power. There, efforts to right the vessel were successful, and the PILGRIM later proceeded to East London to discharge its cargo.

Investigation of this incident revealed several elements which either led to or aggravated the situation. First, rough seas most likely caused the initial grain shift. The possibility that a cargo might shift was taken into account when the International Maritime Organization (IMO) Grain Regulations were written. The maximum allowable vessel list resulting from such a shifting is 12^{o}; this is based on the assumption that the surface of the grain within the cargo holds would shift no more than 15^{o} from the horizontal. Efforts were made to limit shifting of cargo when the PILGRIM was loaded. The grain was trimmed so that all grain surfaces were level and all spaces below tween decks and hatch covers were filled. "Bundles" were installed in certain cargo hatches to restrict the shifting of the grain. These bundles were large, tightly secured bags of grain placed in the square of the cargo hatch after the hold was loaded. Six of them were used on the PILGRIM. Also, hatch covers were used where required by the National Cargo Bureau.

The PILGRIM was fitted with "feeder holes" six inches in diameter in the tween-deck hatch-side girders; these provided a means of feeding additional grain into any void spaces which might form outboard of the hatch-side girders after the hold was filled. The feeder holes were not used in this loading, however.

After the vessel arrived at Capetown, the crew discovered that these precautions had not accomplished their purpose and that shifting in excess of that allowed in the grain regulations had occurred. The average angle of grain surfaces within the cargo holds was about 17.5^{o} from the horizontal. The greatest shift was measured at 19^{o}, while the smallest shift was 13^{o}. Vertical shifting of the grain occurred in every hold in which the hatch cover was closed and grain loaded in the hold above it. In each of these holds, grain, varying in depth from 1½ to 2 feet, was found on top of the bundles. Grain was found to have sifted through the feeder holes in every hold except No. 6 uppertween deck, which was not fitted with feeder holes. Of the six bundles installed at Port Arthur, two were torn and had shifted to the port side. A third bundle, while remaining intact, also had shifted.

Rough seas, heavy rolls, and shifting grain led to the vessel's taking on water. The ingress of water into the vessel was allowed by numerous breaches in the vessel's watertight integrity. In particular, deterioration in the main deck in way of the No. 5 cargo hold, inoperative sideshell check valves, deteriorated gaskets in the side ports, wasted deeptank ventilation piping at the main deck level, and wasted refuse chute closures were noted. In all, it was estimated that a total of 560 tons of water were being shipped on board the vessel prior to its arrival in Capetown.

The Coast Guard investigating officer for this incident recommended that the Coast Guard and the National Cargo Bureau jointly pursue efforts to improve methods for preventing shifts of grain cargoes. Among the points covered in the recommendations were: making sure hatch covers were graintight, preventing grain from sifting through feeder holes, and possibly securing bundles to the vessel's structure to prevent them from shifting. Also emphasized was the importance of a thorough examination of vessels for the type of specific hull defects which existed in this incident, namely, deterioration of the main deck between hatch coamings, deterioration of vent piping on the weather deck, deterioration of closures for drains and other openings which penetrate the hull, and deteriorated gaskets on side port openings. ⚓

The following items are examples of questions included in the Third Mate through Master examinations and the Third Assistant Engineer through Chief Engineer examinations:

DECK

1. The apparent annual path of the sun among the stars is called the

A. equinoctial.
B. solstice.
C. precession.
D. ecliptic

REFERENCE: Bowditch, 1977

2. Clouds appearing in the order cirrus, cirrostratus, altostratus, stratus, and nimbostratus usually indicate the approach of a

The last word on "flammable"/"inflammable" (or is it?)

And now for a postscript to the debate over "flammable" vs. "inflammable" (A Letter from the Editor in the November 1982 issue and Letters to the Editor in the January and April/May 1983 issues):

Dear Editor:

I'm sorry to take you back to November, but your letter from the editor caught my eye again.

Everyone here agrees with you, half the people you queried informally, and Mr. Hatton [the reader who initially questioned the Coast Guard Institute's use of the word "inflammable" in the Nautical Queries]. Certainly if "flammable" means able to burn then "inflammable" must mean the opposite.

However, you said in the next to last paragraph of your letter, "Getting questions on an exam right will do the mariner no good if he later incinerates himself." Didn't you mean "if he burns himself up"? If "inflammable" means not to burn then "incinerate" must mean not to . . .

Very truly yours,

Hilliard L. Lubin
International
Maritime Systems
Bethesda, Maryland

A. cold front.
B. medium front.
C. occluded front.
D. warm front.

REFERENCE: Knight's Modern Seamanship

3. A current rose is used to describe which type of current?

A. Apogean
B. Mixed
C. Rotary
D. Cyclical

REFERENCE: Bowditch, 1977

4. Compensating magnets in magnetic compasses are used to reduce the effects of

A. deviation.
B. local attraction.
C. variation.
D. heeling error.

REFERENCE: Bowditch, 1977

5. "Surging" a line while heaving on it means

A. taking all slack out of the line.
B. slacking it so it does not rotate with the gypsy head.
C. throwing all the turns off the gypsy head.
D. placing a stopper on the bitter end.

REFERENCE: Merchant Marine Officers Handbook

If you have any questions about the Nautical Queries, please contact Commanding Officer, U.S. Coast Guard Institute (mvp), P.O. Substation 18, Oklahoma City, Oklahoma 73169; tel.: (405) 686-4417.

ENGINEER

1. If you were operating a centrifugal water pump with worn wearing rings, the

A. pump would be very noisy.
B. pump would vibrate excessively.
C. pump would develop insufficient pressure.
D. stuffing box would leak excessively.

REFERENCE: Centrifugal Pumps

2. If a laboratory chemical analysis shows that the neutralization number of lube oil used in a certain machinery unit has increased to the point where it exceeds the maximum number allowed, you should

A. centrifuge the oil.
B. add make-up oil.
C. renew the entire oil supply.
D. operate the machinery at reduced power.

REFERENCE: Stinson

3. What is meant by the term "base" when referring to grease?

A. Texture of the grease under load
B. Temperature at which the grease softens or melts
C. Type of soap used in the grease's manufacture
D. Temperature below which the grease will be ineffective as a lubricant

REFERENCE: Elonka, Vol. II

4. One distinct advantage of flash-type evaporators as compared to most other evaporators is that in a flash evaporator

A. lower brine density causes less internal corrosion.
B. scale formation is not a severe problem.
C. cold shocking is more effective in removing scale.
D. water purity is greatly increased at high capacity.

REFERENCE: Osbourne

5. A Bourdon-tube pressure gage used for steam service is protected from steam entering the gage by a(n)

A. exposed, uninsulated coil in the line leading to the gage.
B. impulse-type steam trap in the gage line.
C. leather or neoprene diaphragm in the gage line.
D. spring-loaded bellows in the gage line.

REFERENCE: Osbourne

ANSWERS

DECK
1.D;2.D;3.C;4.A;5.B
ENGINEER
1.C;2.C;3.C;4.B;5.A