

**UNITED STATES COURT OF APPEALS
FOR THE SECOND CIRCUIT**

August Term, 2006

(Argued: March 19, 2007

Decided: March 3, 2008
Amended: July 9, 2008)

Docket No. 05-6116-cv

IN RE M/V DG HARMONY

MARK J. FISHER, INC., DOW AGROSCIENCES LLC, DOW AGROSCIENCES INDUSTRIAL LTDA., WITCO DO BRASIL LTDA., PINTURAS INDUSTRIALES S.A., GRACE ARGENTINA S.A., AKZO NOBEL LTDA., TECHUMESH DO BRASIL, LTDA., HERCULES INTERNATIONAL TRADE CORP. LTD., HERCULES INTERNATIONAL AQUALON DIVISION, HERCULES INC., GRACE CONSTRUCTION PRODUCTS, SUN CHEMICAL EXPORT CORPORATION, AKZO NOBEL CHEMICALS, INC., ROHM AND HAAS COMPANY, ZIPPO MANUFACTURING COMPANY, VICTORINOX DO BRASIL, MCCLANE COMPANY, INC., HANDY CHEMICALS, LTD., KOA FIRE & MARINE INSURANCE CO., N.Y., as subrogee of RICOH LATIN AMERICAN, INTERCARGO INSURANCE COMPANY, GREAT AMERICAN INSURANCE COMPANY, WASHINGTON INTERNATIONAL INSURANCE COMPANY, NEARE, GIBBS & CO., MUTUAL MARINE OFFICE INC., ZURICH AMERICAN INSURANCE CO., as subrogee of PUTNAM ROLLING LADDER CO., INC., E.D. BULLARD, KELLEY CO., INC., RAMCO TRADING, SECURITY INSURANCE COMPANY OF HARTFORD, AGF-MAT, ETHYL PETROLEUM ADDITIVES, INC., DIVERSEY LEVER, CHEESEBROUGH PONDS, BASF CORPORATION, SANDRA R. LEONI, JOSE GUILLERMO MARTINEZ, ORIENTAL FIRE & MARINE INSURANCE CO., LTD., FEDERAL INSURANCE COMPANY, VIGILANT INSURANCE COMPANY, CHUBB & SON, INC., E.I. DU PONT DE NEMOURS AND COMPANY, DEER & COMPANY, INDUSTRIAS JOHN DEERE ARGENTINA, S.A., JOHN DEERE, S.A., INTERAGROVIAL, S.A., ACCION INT'L, INC., DELTA CARGO CORPORATION, MARTINI DISTRIBUCIONES, O.S. INTERNATIONAL TRADING CORP., SIMON ANOS, CHEGARY DE CHALUS, THROUGH TRANSPORT MUTUAL INSURANCE ASSOCIATION LIMITED, MILLER INTERMODAL LOGISTICAL SERVICES, INC., SEA MATES INTERNATIONAL, INC., DAN TRANSPORT CORP., ZKZO NOBEL LTDA., TRANS TANK, BROWN FORMAN BEVERAGES WORLDWIDE, SUPERIOR GRAPHITE CO., MID-MISSOURI-THERMO KING, INC., RAYONNIER, JAS OCEAN SERVICES, INC., MYEEL S.A., SATO

AGRICULTURE TRADING CO., Z & J OVERSEAS TRADING OPERATIONS, LANDER COMPANY INC., MELROSE INTERNATIONAL TRADING LIMITED, CHENEY & ASSOCIATES, LUCY'S TIRE INC., MARCOUER GROUP, KANEMATSU USA INC., FINORA COMPANY INC., GTG CO., INTERNATIONAL OPERATIONS SERVICES CORPORATION, SHARP ELECTRONICS CORP., EQUIPSA, INC., IMEX SHIPPING, INC., NORDIC INSURANCE CO., MARITIME INSURANCE COMPANY, LTD., DISTRIBUIDORA CUMMINS, S.A., GROUPAMA NAVIGATION TRANSPORTS, and UNITED TIRE & RUBBER CO., LTD.,

Consolidated-Plaintiffs-Appellees,

-v.-

M/V DG HARMONY, HER ENGINES, TACKLE, BOILERS, ETC., SOUTH AFRICAN MARINE CORP., LTD., CMBT LINES N.V., LEONHARDT & BLUMBERG, NAVIGATOR SHIPPING LTD., ECONOCARIBE CONSOLIDATORS, INC., AND FLORIDA CONSOLIDATOR, HANJIN SHIPPING CO., LTD., "ALLER" MBH & CO. KG, AMERICAN LINER SYSTEM, INC., in personam, SAFMARINE & CMB T LINES N.V., SCHIFFFAHRTSGES "ALLER" MBH & CO., KG, DIRECT CONTAINER LINE, INC., MONTEMAR S.A. PAN-AMERICAN INDEPENDENT LINE, CONTERM CONSOLIDATION SERVICES, INC., UNITED INTERMODAL LINE, CHO YANG SHIPPING CO., LTD., DSR-SENATOR LINES, DSR-SENATOR GMBH, DI GREGORIO NAVEGACAO, LTDA., SEABRIDGE CONTAINER TRANSPORT, INC., ZIM CONTAINER SERVICES, DACOL CORP., DECAL AIR & SEA CARGO, SAFMARINE CONTAINER LINES, CHALLENGER OCEAN LINES, SHIPCO TRANSPORT, INC., EXPEDITORS INTERNATIONAL OCEAN, INDEPENDENT CARRIERS ALLIANCE, G.S.I. CARGO SYSTEMS, INC., LIBERTY CONTAINER LINES, INC., ZIM-AMERICAN ISRAEL SHIPPING CO., TRANSFREIGHT EXPRESS LINES, LAFCO AMERICAS, INC., DANAMR LINES, CARGO SYSTEMS, INC., FRITZ TRANSPORTATION INTERNATIONAL, and AMBASSADOR LOGISTICS INTERNATIONAL,

Consolidated-Defendants-Appellees,

-v.-

PPG INDUSTRIES, INC., in personam,

Defendant-Appellant.

BEFORE: SACK, B.D. PARKER, and HALL, *Circuit Judges.*

Appeal from an order of the United States District Court for the Southern District of New York (Chin, J.), finding Defendant-Appellant PPG Industries, Inc. solely liable for the explosion and resulting constructive total loss of the M/V DG Harmony. AFFIRMED in part, REVERSED in part, VACATED in part, and REMANDED.

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Appellant.

HALL, *Circuit Judge:*

Defendant-Appellant PPG Industries, Inc. (“PPG”) appeals from an interlocutory order of the United States District Court for the Southern District of New York (Chin, J.) finding PPG solely liable for the explosion and resultant constructive total loss of the M/V DG Harmony and its cargo. *See* 28 U.S.C. § 1292(a)(3). We reverse the district court’s determination that PPG was strictly liable under § 4(6) of the Carriage of Goods by Sea Act, 46 U.S.C. § 30701 note (“COGSA”). We also reverse the district court insofar as it held PPG liable under a general negligence theory. Finally, with regard to failure-to-warn negligence under COGSA § 4(3), we affirm the district court’s ruling that PPG had a duty to warn and that PPG breached that duty, as

well as the district court's factual finding that PPG's dangerous cargo caused the explosion. We vacate the judgment, however, because the district court failed to address whether a warning, if given, would have prevented the harm, and we remand for further proceedings on that issue.

AFFIRMED in part, REVERSED in part, VACATED in part, and REMANDED.

BACKGROUND

I. The Loss of the M/V DG Harmony

The M/V DG Harmony ("Harmony") was a 176.57 meters-long container ship registered in the Isle of Man and owned by Navigator Shipping Ltd. ("Navigator"), a subsidiary of Safmarine and CMBT Lines N.V. ("SCL"). Capable of carrying approximately 1800 standard containers, the Harmony was equipped with three separate holds, each of which was designed to carry dangerous goods. At the time of its destruction the Harmony was on charter to, inter alia, Di Gregorio Navegacao, Ltda., Cho Yang Shipping Co., and DSR-Senator Lines GmbH. Together, these owners and charterers ("the ship-owning interests") are the Consolidated-Defendants-Appellees in this action.

The Harmony's final voyage began in New York in late October 1998. Bound for points in South America, the Harmony made stops in Newport News, Savannah, and Miami. At these ports, the Harmony took on containers immuring cargo owned by various entities which, with one important exception, together comprise the Consolidated-Plaintiffs-Appellees in this action ("the cargo owners"). Although most of these cargoes proved innocuous, one did not; at Newport News, Virginia, the Harmony received and stowed, through its charterer Cho Yang Shipping Co., ten containers, each of which contained approximately 16,000 kilograms of

calcium hypochlorite (hydrated) (“calhypo”). The parties agree that this substance, manufactured and shipped by Defendant-Appellant PPG Industries, Inc. (“PPG”), precipitated the subsequent explosion and fire on the Harmony.¹

On November 9, ten days after leaving Miami, the Harmony reached a point off the northern coast of Brazil. At approximately 7:20 a.m., an explosion ripped through the third hold. The Captain and crew of the Harmony, realizing that the third hold had caught fire, mobilized to fight the blaze. For nearly twelve hours, the full crew battled the flames, but their efforts were to no avail. Most of the crew abandoned ship at 6:00 p.m. that evening, and they were followed by the Captain and the remainder of the crew at 2:00 a.m. the next day. Although there were no casualties, the Harmony burned for three weeks. The fire resulted in a constructive total loss of both the vessel and its cargo.

II. The Properties of PPG’s Calhypo

A. The Properties of Calhypo

In divining the cause of the fire, the parties focused on PPG’s calhypo, an industrial bactericide sometimes identified as “UN 2880,” its designation under the International Maritime Dangerous Goods Code (“IMDG Code”). Calhypo is an unstable substance that continually

¹ We recently decided another case involving an explosion aboard a containership that was precipitated by calhypo, *Contship Containerlines, Ltd. v. PPG Indus., Inc.*, 442 F.3d 74 (2d Cir.), *cert. denied*, 127 S. Ct. 565 (2006), and other courts have also encountered cases involving calhypo, *e.g.*, *Lowe’s Home Ctrs., Inc. v. Olin Corp.*, 313 F.3d 1307 (11th Cir. 2002); *Ionmar Compania Naviera, S.A. v. Olin Corp.*, 666 F.2d 897 (5th Cir. 1982); *Compania Sudamericana de Vapores S.A. v. Sinochem Tianjin Co.*, No. 06 Civ. 13765(WHP), 2007 U.S. Dist. LEXIS 24737 (S.D.N.Y. Apr. 4, 2007); *Standard Commercial Tobacco Co. v. M/V “Recife”*, 827 F. Supp. 990 (S.D.N.Y. 1993).

decomposes at room temperature. It is an oxidizer, which means that it releases oxygen in most reactions.

Most importantly, however, calhypo is prone to “thermal runaway,” a phenomenon in which the heat naturally produced by the calhypo serves to heat the calhypo further, thus causing it, in turn, to generate even more heat. Thermal runaway operates like a feedback loop. As one expert witness explained, “[t]he higher the temperature, the faster the reaction, and the reaction becomes circular inasmuch as it generates the heat, [and the heat] causes [the reaction] to go faster.” This snowballing reaction “runs away, goes critical, and [it] get[s] to the point where it just goes so fast that the material explodes, it deflagrates, decomposes and reaches the point where we have a fire ensuing.” A number of extrinsic factors can exacerbate this phenomenon. For example, if calhypo is tightly enclosed in a container from which heat cannot easily escape, it might more easily succumb to thermal runaway. Likewise, calhypo might more readily exhibit thermal runaway if exposed to an external or “radiant” source of heat.

The most important factor in predicting the decomposition and eventual combustion of calhypo is its “critical ambient temperature” or “CAT.” As PPG correctly notes, “CAT is the minimum temperature at which a heat-sensitive product will begin to retain more heat than it dissipates.” The CAT of a given amount of calhypo “depends inversely upon the size of the sample; as the mass increases, the critical temperature decreases.” *Standard Commercial Tobacco Co. v. M/V “Recife”*, 827 F. Supp. 990, 993 (S.D.N.Y. 1993). For example, in *Recife*, the district court found that the CAT “of a single pellet of [calhypo] is approximately 180 degrees C.” *Id.* In the instant case, which involves a much larger amount of calhypo, the district court found the CAT to be considerably lower. The exact CAT is elusive. One expert in this case

“testified that he did not find any data from which he could ascertain the . . . CAT of the ‘specific material’ carried on the Harmony.” *In re M/V DG Harmony*, 394 F. Supp. 2d 649, 669 n.28 (S.D.N.Y. 2005). Nevertheless, the district court believed it could make a rough estimate of the CAT of the calhypo onboard the Harmony, judging it to be below 41°C. *Id.* at 669.

B. PPG’s Packaging Method

PPG manufactures its calhypo at a plant in Natrium, West Virginia. To package the calhypo stowed on the Harmony, PPG used thick cardboard drums that weighed 136 kilograms (about 300 pounds) each when full. PPG loaded the drums on wooden pallets, four drums to a pallet, and immediately shrinkwrapped each four-drum bundle. Thirty pallets were then packed into each container, stacked up in three layers of ten pallets each. Each layer of pallets was divided into two rows of five pallets. For its shipment on the Harmony, PPG prepared ten containers in this manner. The district court found that this packaging method was likely to have lowered the CAT of the calhypo; stacking the drums made it “harder for the heat to dissipate” while “the container walls inhibit[ed] the ventilation of the drums.” *Id.* at 657. The calhypo was approximately 34°C when it was packaged, “36 hours after [manufacturing], under circumstances that did not permit it to cool down.” *Id.* at 660. After packaging the calhypo, PPG trucked the containers to Baltimore, where agents for Cho Yang Shipping Co. arranged transport to Norfolk, Virginia. In Norfolk, the charterers’ stevedores facilitated stowage of the calhypo onboard the Harmony in neighboring Newport News, Virginia.

C. The Location of Calhypo in the Hold of the Harmony

The stevedores stowed the containers contiguously on the far port side of Harmony's third hold. Three of the containers—those occupying slots 270802, 250802, and 250804—sat adjacent to a J-shaped “heated port side bunker [fuel] tank,” and they were separated from the tank wall by twelve inches of empty space. *Id.* at 661. Two of these three containers—those occupying slots 270802 and 250802—sat directly atop the bunker tank, separated from the tank wall by less than twelve inches of empty space. In other words, two containers were exposed directly to the radiant heat of the bunker tank on two sides, and one container was exposed to radiant heat on one side. The remaining containers lay amidships, block-stowed contiguously with these three containers. One of these remaining containers, occupying slot 250404, sat “three in from the port side” bunker tank and “two up from the bottom.” *Id.* at 667. As the district court concluded from an exhaustive review of the physical evidence, this container was the source of the explosion and resulting fire. *Id.* at 667–69. Both the Captain and Chief Mate of the Harmony approved this stowage arrangement.

III. Warnings About Calhypo

A. The IMDG Code

The International Maritime Organization (the “IMO”) maintains a schedule of dangerous materials known as the IMDG Code. The United States has ratified the International Convention for the Safety of Life at Sea (“SOLAS”), Nov. 1, 1974, 32 U.S.T. 47, which incorporates through amendment the IMDG Code. *Recife*, 827 F. Supp. at 994. Thus, although the IMDG Code is not controlling in this tort action, it serves as an important reference for carriers seeking to transport

cargo safely and efficiently while complying with international regulations. *See Harmony*, 394 F. Supp. 2d at 657.

The Code regulates the transport of dangerous goods by sea “in order reasonably to prevent injury to persons, or damage to the ship” or “the marine environment.” IMDG Code 1.1 (1998). “At the same time, however, any regulation should be so framed as not to impede unnecessarily the movement of such goods.” *Id.* The Code further contains a number of general guidelines that apply to all cargo. For example, the Code states that “[i]n view of the high protective advantages, stowage *under deck* has been recommended wherever possible, except that, for certain [explosives] whose principal hazard is the production of smoke or toxic fumes, stowage *on deck* has been recommended.” *Id.* at 14.6. “Where it is necessary to prevent pressure build-up, decomposition or polymerization of a substance, the packages should be stowed *shaded from radiant heat*, which includes protection from strong sunlight.” *Id.* at 14.12. When stored below deck, substances vulnerable to radiant heat should be stowed “‘away from’ sources of heat, including sparks, flame, steam pipes, heating coils, etc.” *Id.* at 14.13.

Under the Code, calhyo is a Class 5.1 oxidizing substance. In general, all oxidizing substances, “although in themselves not necessarily combustible, may, either by yielding oxygen or by similar processes, increase the risk and intensity of fire in other materials with which they come into contact.” *Id.* at 5.1.5. In addition to its general rules on substances vulnerable to radiant heat, the Code requires that carriers store calhyo in particular “‘[a]way from’² sources of

² The Code defines “away from” as “[e]ffectively segregated so that the incompatible goods cannot interact dangerously in the event of an accident but may be carried in the same compartment or hold or *on deck*, provided a minimum horizontal separation of **3 metres, projected vertically**, is obtained.” IMDG Code 15.2.2.1.1.

heat where temperatures in excess of 55°C for a period of 24 hours or more will be encountered.” The Code further requires that calhyppo be “[s]eparated from”³ powdered metals, ammonium compounds, cyanides and hydrogen peroxide.”

The IMDG Code also imposes temperature-related requirements that apply by implication to the stowage of calhyppo. Section 21.2.3.1 requires that material with a self-accelerating decomposition temperature (or “SADT”)⁴ of over 35°C be stored at a control temperature of 10°C below the SADT. The SADT “should be determined in accordance with the latest version of the United Nations *Recommendations on the Transport of Dangerous Goods, Manual of Tests and Criteria.*” *Id.* at 21.2.3 n.*. The district court did not venture a finding as to the SADT according to this United Nations document.

The U.S. Department of Transportation (“DOT”) regulations largely repeat the general aspects of the IMDG Code, but they add that for “transportation by vessel, shipments are authorized in accordance with the control temperature requirements in Chapter 7.7 of the IMDG Code.” 49 C.F.R. § 173.21(f)(3)(ii).⁵

³ The Code defines “separated from” as “[i]n different compartments or holds when stowed *under deck*. Provided the intervening deck is resistant to fire and liquid, a vertical separation, i.e. in different compartments, may be accepted as equivalent to this segregation. For *on deck* stowage, this segregation means a separation by a distance of **at least 6 metres horizontally.**” IMDG Code 15.2.2.1.2.

⁴ A material’s SADT is closely related to its CAT. We do not explicate the difference as it does not affect the resolution of this appeal.

⁵ Among other things, the DOT regulations forbid the transport of “[a] package containing a material which is likely to decompose with a self-accelerated decomposition temperature (SADT) of 50° C (122° F) or less . . . with an evolution of a dangerous quantity of heat or gas when decomposing . . . unless the material is stabilized or inhibited in a manner to preclude such evolution. The SADT may be determined by any of the test methods described in Part II of the UN Manual of Tests and Criteria” 49 C.F.R. § 173.21(f). The regulations

B. Recent Industry Warnings

In September 1998, before the *Harmony* commenced its voyage from New York, its Captain received a “box of correspondence, videos, and other materials from Leonhardt & Blumberg,” the *Harmony*’s vessel management company. *Harmony*, 394 F. Supp. 2d at 662. The box included a circular from the “Swedish Club,” a member-owned mutual insurance company. That circular, entitled “MEMBER ALERT: July 1998: Calcium Hypochlorite (Hydrated) UN No. 2880,” stated:

In the course of investigating a serious fire onboard a container vessel, the fire experts appointed by us have undertaken a research of how [calhypo] reacts to heat exposure. The preliminary results have such serious implications regarding the transportation of this material that we have decided to immediately advise the shipping community of the findings.

...

The current IMO recommendation is that material is not to be exposed to a heat source in excess of 55°C for longer than a 24-hour period. Preliminary results of the research indicate, however, that for the type and size of packaging used routinely to ship this material around the world, the temperatures at which the runaway reaction is likely to begin may be much lower than that recommended by the IMO

It is our understanding that the ambient temperature of holds of certain container ships can reach the critical ignition temperature of this material, which preliminary results of our research suggests is considerably lower than that previously published.

continue on: “A package meeting the criteria of paragraph (f) of this section may be required to be shipped under controlled temperature conditions. The control temperature and emergency temperature for a package shall be as specified in the table in this paragraph based upon the SADT of the material. The control temperature is the temperature above which a package of the material may not be offered for transportation or transported. The emergency temperature is the temperature at which, due to imminent danger, emergency measures must be initiated.” *Id.* § 173.21(f)(1).

Accordingly, it is suggested that this material is not shipped in the holds of such ships and if stowage on deck is arranged, heating of this material by direct sunlight must be avoided.

Although the Captain received this warning prior to setting off from New York, he did not read it.

This Swedish Club circular reflected warnings that had already begun to circulate in the shipping community. For example, one week prior to the Swedish Club's circular, the same consulting group that was hired by the Swedish Club shared its preliminary findings with respect to calhypo. These warnings were prompted by the destruction of the *Contship France*, a containership carrying cargo that included calhypo manufactured by PPG. *See Contship Containerlines, Ltd. v. PPG Indus., Inc.*, 442 F.3d 74, 75 (2d Cir.), *cert. denied*, 127 S. Ct. 565 (2006).

C. Specific Notice of Dangerous Goods Issued by PPG

PPG furnished assorted documentation with its containers of calhypo. A dangerous goods summary accurately identified the contents of the containers as calhypo and provided the relevant IMDG classification information. Dock receipts also identified the material as calhypo and declared that “the packing of the container/vehicle has been carried out in accordance with the general introduction [of the] IMDG code, Paragraph 12.3.7.” An accompanying Material Safety Data Sheet cautioned that the calhypo should be stored “in a cool, dry, well-ventilated place . . . away from heat, sparks, flames, direct sunlight, and other sources of heat, including lighted tobacco products.” This sheet further warned that the calhypo was “[u]nstable above 117

C” and would “[d]ecompose[] at 180 C.” The remainder of the seven-page document focused on first aid, firefighting, and ecological and other general concerns.

IV. The Decision of the District Court

After the loss of the *Harmony*, various parties filed lawsuits in the Southern District of New York. *Harmony*, 394 F. Supp. 2d at 651. Most of the parties settled their claims, and eventually only the disputes between PPG and the ship-owning and cargo interests remained. The ship-owning and cargo interests alleged that PPG was liable for the loss of the *Harmony* under theories of general negligence, negligent failure to warn, and strict liability. PPG contested these allegations, arguing that the ship-owning interests bore some responsibility for stowing the calhypo adjacent to a heated bunker tank. After a bench trial, the district court found PPG solely liable for the loss of the *Harmony* under theories of negligent failure to warn and strict liability. *Id.* at 675. It is unclear whether the district court rendered judgment on a theory of general negligence. In a subsequent clarification of its opinion, the district court also absolved the ship-owning interests of fault, finding that stowage decisions played no causal role in the explosion and fire that destroyed the *Harmony*.

Defendant-Appellant PPG initiated this appeal.

DISCUSSION

I. General Negligence

The parties disagree on whether there is an issue of general negligence in this case that was determined by the district court. In its decision, the district court stated that the ship-owning

interests and the cargo owners separately advanced failure to warn and negligence claims. *Id.* at 672–73. Yet when finding PPG liable, the district court applied what appears to be a single legal test. The court found both that the calhypo was “unreasonably dangerous when it left PPG’s control” and that “PPG failed to give adequate warnings on the handling and transportation of the product.” *Id.* at 673. As a result, the ship-owning and cargo interests argue that the district court found PPG liable on both general negligence and for negligent failure to warn, while PPG argues that the district court rested its decision solely on failure to warn. More specifically, the ship-owning interests argue that PPG was negligent in its packaging of the calhypo, in its certification that the calhypo was safe for transport, in failing to request refrigerated or on-deck stowage, and for other oversights in its actions surrounding the calhypo.

At trial, however, the arguments made by the parties indicated that they understood the general negligence claim to be a variation of negligence per se based on PPG’s alleged violation of 49 C.F.R. § 173.21(f). Section 173.21(f) prohibits transport of material “which is likely to decompose with a self-accelerated decomposition temperature (SADT) of 50° C (122° F) or less . . . with an evolution of a dangerous quantity of heat or gas when decomposing . . . unless the material is stabilized or inhibited in a manner to preclude such evolution.” For example, when clarifying the different legal theories of the case, an attorney for the cargo interests stated that failure to warn was “the principal negligence theory” but that the case also raised the issue of “[v]iolation of [DOT] regulations when they shipped the goods.” Furthermore, in PPG’s closing arguments it stated that “the claim against PPG is grounded in 49 CFR, the assertion that this was a ‘forbidden’ material and that therefore PPG should not have shipped it unless it did so in refrigerated containers.”

The district court’s opinion, however, does not mention negligence per se, nor does it devote much attention to PPG’s compliance with § 173.21(f). Though the opinion contains broad language suggesting that PPG breached its general duty of due care, *see Harmony*, 394 F. Supp. 2d at 674 (“[A] reasonable manufacturer would have done more than PPG did here.”), its primary focus was on PPG’s duty to warn. In its clearest recital of the elements of the claim, the court found that PPG “had a duty to provide a warning that would fully inform vessels and others in the distribution chain of all the risks involved in shipping cal-hypo in the manner in which it was shipped here. PPG breached that duty.” *Id.* at 675. We therefore agree with PPG that the district court did not find PPG liable on a general negligence theory. To the extent that the district court’s opinion can be understood to make such a finding, we reverse because the district court provided no basis for a finding of general negligence other than the incorrect one of unreasonable dangerousness (a strict liability doctrine).

II. Strict Liability

Relying principally on our recent decision in *Contship*, 442 F.3d 74, PPG argues that the ship-owning interests cannot prevail on strict liability in this case. We agree. The Carriage of Goods by Sea Act (“COGSA”),⁶ 46 U.S.C. § 30701 note, articulates the duty applicable to shippers and carriers of “[i]nflammable, explosive, or dangerous cargo,” *id.* note § 4(6). By its

⁶ For an overview of COGSA and the history of its enactment, see Joseph C. Sweeney, *The Prism of COGSA*, 30 J. Mar. L. & Com. 543 (1999); Michael F. Sturley, *The History of COGSA and the Hague Rules*, 22 J. Mar. L. & Com. 1 (1991); and 2 Michael F. Sturley, *The Legislative History of the Carriage of Goods by Sea Act and the Travaux Préparatoires of the Hague Rules* 116 (1990).

terms, “the shipper of such goods shall be liable for all damages and expenses directly or indirectly arising out of or resulting from such shipment.” *Id.*

Our Circuit has rendered two decisions on this rule that are particularly relevant here. In *Senator Linie GMBH & Co. KG v. Sunway Line, Inc.*, 291 F.3d 145 (2d Cir. 2002), we sought to determine liability in a case where *neither the shipper nor the carrier* knew of the dangerous properties of thiourea dioxide, a compound that spontaneously combusted when the vessel was en route from Korea to the United States. In resolving the subsequent dispute over which party was responsible for the loss, we held that COGSA § 4(6) established a standard of strict liability for shippers of dangerous goods, at least “when neither the shipper nor the carrier had actual or constructive preshipment knowledge of the goods’ dangerous nature.” *Senator Linie*, 291 F.3d at 148; *see also id.* (acknowledging that “this case involves the rare circumstance in which neither party had actual or constructive preshipment knowledge” that the goods were dangerous).

In *Contship*, 442 F.3d 74, we considered the duties of shipper and carrier where both knew of the risks presented by a cargo. The *Contship France* caught fire after 512 drums of PPG-manufactured calhypo, each weighing 425 pounds, combusted in the hold. *Id.* at 75–76. The calhypo was “stowed directly above the bottom center fuel tank,” the contents of which were, at some point during the voyage, “heated to abnormally high temperatures.” *Id.* at 76. Confronted with these facts, we held that “a carrier cannot invoke strict liability if it knows that a cargo poses a danger and requires gingerly handling or stowage, and nevertheless exposes the cargo to the general condition that triggers the known danger, regardless of whether the carrier is aware of the precise characteristics of the cargo.” *Id.* at 77; *accord APL Co. Pte, Ltd. v. UK Aerosols Ltd.*, No. C 05-0646 MHP, 2006 U.S. Dist. LEXIS 70704, at *26–27 (N.D. Cal. Sept. 28, 2006). For

the purposes of the strict liability inquiry, the question of knowledge was a threshold, “binary” inquiry: “[A] party either will know that such a reaction is possible or it will not; the calibrated likelihood of an exothermic reaction under a variety of heat circumstances is not considered.” *Contship*, 442 F.3d at 77. “A carrier that exposes a cargo to heat with knowledge of its flammability may or may not ultimately prevail . . . but it cannot prevail on strict liability.” *Id.* Thus, if either party knows that “such a reaction is possible,” liability is determined by reference to negligence principles rather than strict liability. *Id.*

In this case, the ship-owning interests may not have known “the precise characteristics of the cargo,” but they knew that calhypo was an unstable substance that became vulnerable to combustion when heated. Despite this knowledge, the ship-owning interests exposed the calhypo to the general condition—heat—that induces such combustion. As a result, although they may prevail on a negligence theory, the ship-owning interests “cannot prevail on strict liability.” *Id.* We therefore reverse the judgment of the district court insofar as it found PPG strictly liable for the destruction wrought by its shipment of calhypo.

Having found that the ship-owning interests cannot prevail against PPG in strict liability, we must also consider the effect that finding has on the cargo interests’ ability to bring a strict liability claim against PPG under COGSA. This Court has not yet determined whether third parties may bring claims under COGSA. We assume for the moment that they may.⁷

⁷ Although the cargo interests’ complaint claimed generally that PPG was “strictly liable in tort,” at trial and on appeal the cargo interests presented their strict liability claim as one arising under COGSA. We therefore treat the cargo interests’ strict liability claim as a COGSA claim, and we do not consider whether the cargo interests can recover in strict liability under the common law.

As noted above, in *Contship*, this Court held that a carrier could bring a strict liability claim against a shipper under COGSA § 4(6) only if the carrier had no notice of the cargo's dangerousness. There, the carrier could not recover because it had notice of the general dangerousness of the calhypo, and it thus had "knowledge of [the material's] nature and character." See *Contship*, 442 F.3d at 78 ("In this case, such a 'nature and character' inquiry defeats *Contship*'s strict liability claim."). We reached that holding by reference to the text of § 4(6), which states that a shipper is strictly liable for damages caused by its dangerous goods only when "the carrier . . . has not consented with knowledge of their nature and character." 46 U.S.C. § 30701 note § 4(6). A carrier has "knowledge," we held, when it has notice of any aspect of the cargo's dangerousness. Such knowledge defeats the carrier's ability to recover against the shipper in strict liability.

The cargo interests argue that this requirement, recognized in *Contship*, does not apply to their strict liability claims. There is nothing in the statute nor in our holding in *Contship*, however, that limits the application of this requirement to claims brought by carriers. Based, as it is, on the text of the statute, the requirement applies to any strict liability claim brought under § 4(6), whether those claims are brought by carriers or by third-party cargo owners. In other words, the language of § 4(6), which makes shippers strictly liable for damages caused by dangerous goods only when "the carrier . . . has not consented with knowledge" of their dangerousness, requires that any plaintiff seeking to recover against a shipper in strict liability must first show, as an element of the claim, that the carrier did not have such notice. *Contship* further instructs that the required showing cannot be made if the carrier had any notice of the

goods' dangerousness, even if that notice was incomplete or reflected an underestimation of the danger.

Thus, to prevail on the strict liability claim against PPG that we assume (though do not hold) the cargo interests may bring under COGSA, the cargo interests must show that the carrier did not have notice that calhyo was dangerous. As we concluded above, however, the ship-owning interests (the "carrier" for the purposes of COGSA) had knowledge of the "nature and character" of PPG's calhyo, because they had notice of its instability and heat sensitivity. That knowledge on the part of the carrier prevents the cargo interests from satisfying the "without knowledge" element of the strict liability claim they seek to bring against PPG under COGSA, and their inability to prove that element is fatal to the entire claim.

III. Negligent Failure to Warn

COGSA § 4(3) provides that "[t]he shipper shall not be responsible . . . from any cause without the act, fault, or neglect of the shipper, his agents, or his servants." 46 U.S.C. 30701 note § 4(3). A shipper's negligent failure to warn the carrier about dangers inherent in a cargo constitutes such "fault" or neglect and gives rise to a cause of action for negligent failure to warn. *Contship*, 442 F.3d at 78 ("A shipper's failure to adequately inform a carrier of the foreseeable dangers posed by cargo can constitute a negligent failure to warn under [COGSA § 4(3)]."). To prevail on a claim of negligent failure to warn, the plaintiff must demonstrate "(1) that PPG failed to warn [the carrier] about dangers inherent in the cargo of which the stevedore and ship's master could not reasonably have been expected to be aware; and (2) that an absent warning, if given, would have impacted stowage." *Id.* (internal quotation marks omitted). That is, in the

traditional elements of negligence liability, plaintiff must show that: (1) the defendant had a duty to warn because the cargo presented “dangers . . . of which the stevedore and ship’s master could not reasonably have been expected to be aware,” *id.* at 78 (internal quotation marks omitted); (2) the defendant breached that duty by failing to provide an adequate warning; and (3) the breach in duty caused (4) the resulting harm. Neither party contests that harm occurred. Our review of the district court’s ruling, therefore, focuses first on the elements of duty and breach before considering the element of causation.

A. PPG’s Breach of Duty

Under the element of duty, the plaintiff must show that the shipper had a duty to warn because the cargo presented dangers about which the carrier could not reasonably be expected to know. Because the existence of this duty is ultimately a question of law, *see Burke v. Spartanics Ltd.*, 252 F.3d 131, 139 (2d Cir. 2001), our review is *de novo*, *Ching Sheng Fishery Co. v. United States*, 124 F.3d 152, 157 (2d Cir. 1997). We review the district court’s factual findings, however, for clear error. *Contship*, 442 F.3d at 77.

Whether a cargo posed dangers “of which the [carrier] could not reasonably have been expected to be aware,” *id.* at 78, is principally a legal question that hinges on a legal judgment about what the carrier reasonably should have known. Unlike the threshold “binary” knowledge inquiry in the strict liability context, the reasonable awareness inquiry asks whether it would have been reasonable to expect the carrier to know of the *specific type and degree of danger* posed by the cargo at issue. Answering this question requires a fact-sensitive, “calibrated” analysis of the cargo’s dangerousness and the extent to which that risk was different from risks commonly

encountered by carriers. *Cf. id.* at 77 (holding that even if, as a result of its general awareness of a cargo’s danger, a party “cannot prevail on strict liability,” it may “ultimately prevail” on another theory). Two principles bear upon the determination of the dangers that are normally associated with a cargo. First, when receiving a cargo like calhypo, the dangerousness of which is not open and obvious, a carrier may rely on the shipper’s attestations as to the cargo’s characteristics. In the shipping industry, stevedores and ship’s masters often must make quick and complex stowage decisions about diverse containerized cargoes. *Senator Linie*, 291 F.3d at 169. “In contrast to a carrier, which typically is in the position of taking aboard its vessel a large quantity and variety of cargoes, a shipper can be expected to have greater access to and familiarity with goods and their manufacturers before those goods are placed in maritime commerce.” *Id.*; *see also O’Connell Mach. Co. v. M.V. “Americana”*, 797 F.2d 1130, 1134 (2d Cir. 1986) (“[T]he carrier . . . did not have a duty to inspect the contents of the cargo . . . before assigning a stowage location Rather, the shipper had an obligation to inform the carrier of special requirements regarding stowage location, and to make such special arrangements in advance of stowage”); William Tetley, *Marine Cargo Claims* 489 (3d ed. 1988) (“Where the container is packed and sealed by the shipper, then the carrier has only its general knowledge of such type of goods in the light of the description on the bill of lading.”). For that reason, we generally will not charge stevedores and ship’s masters with encyclopedic knowledge beyond the shipper’s attestations. The district court, when determining the dangers normally associated with a cargo, should begin—and typically will end—with the shipper’s attestations. Second, when evaluating the legal significance of apparently contradictory information in the shipper’s

description or warning, the specific controls the general. *J. Aron & Co. v. The Askvin*, 267 F.2d 276, 277 (2d Cir. 1959).

The district court correctly found that PPG's calhypo presented dangers about which the carrier could not reasonably be expected to know and that PPG therefore had a duty to warn. *Harmony*, 394 F. Supp. 2d at 673. PPG's attestations and the IMDG Code shaped the carrier's reasonable expectations about the dangers of its calhypo. PPG's Material Safety Data Sheet warned that the calhypo was unstable at temperatures above 117°C. The IMDG Code required calhypo to be kept away from sources of heat where temperatures greater than 55°C will be encountered for longer than twenty-four hours. The district court found, however, that because PPG's calhypo was packaged, while still warm, in an unusual configuration, it had a CAT of below 41°C. Furthermore, although the IMDG Code warned only of temperatures above 55°C, the calhypo packaged by PPG "should [have] be[en] stowed at temperatures substantially lower." *Harmony*, 394 F. Supp. 2d at 675. Although PPG challenges these factual findings, they are not clearly erroneous. Based on these findings, the district court—in keeping with our understanding that the duty element requires a "calibrated" inquiry into whether the carrier reasonably would have known of the precise risks presented by the cargo—held that PPG had a duty to warn of "all the risks involved in shipping cal-hypo *in the manner in which it was shipped here.*" *Id.* at 675 (emphasis added).

After finding that the dangers posed by PPG's calhypo gave rise to a duty to warn, the district court went on to find that PPG had breached that duty because its warnings were "inadequate and misleading." *Id.* at 674. In other words, PPG's breach of duty consisted of its failure to warn the carrier of the dangers posed by the calhypo it was shipping in this particular

configuration. The district court’s conclusion that PPG breached its duty to warn thus rests on its findings with respect to the dangerous nature of PPG’s calhypo, and as we have already held, those findings are not clearly erroneous. We therefore will not disturb the district court’s finding that PPG breached its duty to warn.

B. Causation

In addition to proving duty and breach, the plaintiff must prove causation. When the plaintiff alleges failure to warn, it must show that it was the defendant’s breach of duty—the failure to warn of the dangers about which the carrier could not reasonably be expected to know—that caused the harm of which plaintiff complains. *Cf. Spartatics*, 252 F.3d at 139. Divided into its constituent parts, this inquiry consists of two separate prongs. First, the plaintiff must show that the dangerousness of the cargo, about which the carrier could not reasonably be expected to know, caused the harm. Second, the plaintiff must show that the warning, “if given, would have impacted stowage.” *Contship*, 442 F.3d at 78. Because the district court’s finding of causation is a factual determination, we review for clear error. *Id.* at 79. We affirm the district court’s finding that the danger posed by PPG’s calhypo, about which the carrier could not reasonably be expected to know, caused the explosion onboard the Harmony. Because, however, the district court did not determine whether a warning, if given, would have prevented that harm by changing the carrier’s stowage decision, we remand the case for further proceedings.

1. Threshold Causation

The district court found that thermal runaway in container 250404 caused the explosion and resulting fire on the Harmony. In arriving at this ultimate finding of causation, the district court made numerous predicate findings of fact. Among them, the district court first found “beyond any reasonable doubt, that the fire started in the cal-hypo containers.” *Harmony*, 394 F. Supp. 2d at 669. The temperature of the third hold, where the calhypo was stowed, “ranged from approximately 35°C to approximately 40°C.” *Id.* at 661. When the calhypo in container 250404, made “less stable than anyone realized” by PPG’s packaging methods, *id.* at 669, encountered the “normal and expected” ambient temperatures in the third hold, *id.* at 670, it entered thermal runaway. According to the district court, this “is the most logical, if not the only logical, explanation” of what caused the fire and explosion onboard the Harmony. *Id.* at 669.

The district court reached this conclusion in part by process of elimination, rejecting PPG’s alternative theory of causation. PPG had argued that the fire started because heat from the ship’s bunker tank subjected the calhypo to radiant heat throughout the voyage, thereby heating the calhypo containers until one of them combusted. The district court found, however, that although the heated tanks affected the hold’s temperature, the fuel was only 37°C on the day before the fire and the fuel tank was not being heated at the time of the fire.⁸ *Id.* at 661 n.19.

⁸ This finding was critical in distinguishing the facts here from the facts in *Contship*, where, under superficially similar circumstances, we held the carrier responsible rather than PPG. *See Contship*, 442 F.3d at 78. Whereas the district court in the instant case found that PPG’s packaging method lowered the CAT of the calhypo and thereby caused the explosion, the district court in *Contship* found that the carrier heated its fuel to “abnormally high temperatures,” *id.* at 76, “was unconcerned with the effect of heat on Cal Hypo,” *id.* at 79, and had “stowed the flammable, heat-sensitive Cal Hypo near the heated fuel tank, an area of the ship maximally subjected to fluctuations of heat,” *id.*

On appeal, PPG argues that two of the district court’s discrete factual findings are clearly erroneous. First, PPG charges, there “is no substantial evidence supporting the estimated . . . hold temperature of ‘approximately 40°C.’” Second, PPG asserts, the district court’s finding that the calhypo in question had a CAT of below 41°C “is not substantiated by the record.” We are unpersuaded. In making these findings, the district court drew from a voluminous record as well as the testimony of assorted opposing witnesses. In light of the record as a whole, these discrete findings are plausible; we are not left with the definite and firm conviction that error has been committed. Accordingly, the district court’s finding that the dangerousness of PPG’s calhypo caused the explosion was not clearly erroneous.

2. *The Causal Effect of the Absent Warning*

Although we affirm the district court’s factual finding on threshold causation, the element of causation is satisfied only if plaintiff goes on to prove that the absent warning, if given, would have affected the carrier’s stowage decision and thus prevented the explosion. *Contship*, 442 F.3d at 78 (“[L]iability for failure to warn is only appropriate if there is evidence that a warning would have altered the carrier’s actions.” (internal quotation marks and alteration omitted)). The district court did not address this second prong of the causation inquiry in any way, and because that question presents an issue of fact, we cannot consider it for the first time on appeal. For that reason, we vacate the district court’s judgment in favor of the plaintiffs, and we remand the case so that the district court can address the second prong in the first instance.

CONCLUSION

We REVERSE the district court insofar as it holds PPG liable on a general negligence theory. We further REVERSE the district court's judgment insofar as it holds PPG strictly liable. With regard to the district court's finding that PPG is liable for negligent failure to warn, we VACATE the judgment of the district court and REMAND for further proceedings consistent with this opinion.