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SYNFUEL

A Western Rivers Marine Transportation Risk Assessment

Radisson Hotel
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Huntington, West Virginia

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TABLE OF CONTENTS

Executive Summary	page 3
Defining the Problem	page 4
Gathering Experts	page 5
Identifying the Hazard	page 6 - 7
Defining System Processes	page 8
Identifying Dominant Incidents	page 9
Identifying High Risk Incidents	page 10 - 12
Evaluating Effectiveness and Cost	page 13 - 14
Recommending Standards of Care	page 15
Defining the Standards of Care	page 16 - 17
Conclusions and Recommendations	page 18
Stakeholder Review Panel	page 19

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EXECUTIVE SUMMARY

Synthetic fuel manufacturers are producing synfuel because associated tax incentives have allowed them to provide bulk coal consumers with a cheaper energy source. These consumers consist of power plants, coke plants, steel manufacturers, etc. Some of the synfuels being produced consist of approximately 99% coal and 1% oil emulsion. These oil-coal synfuels have produced sheens in the marine environment when accidentally released. The sheen sighting in turn prompts a Coast Guard response with possible pollution fines and costly mitigation efforts. There are no current regulatory requirements for the marine transportation of synfuel; treating the synfuels as an oil product from a marine transportation perspective would be cost prohibitive; treating the synfuels as coal may not be conducive to the marine environment. Somewhere between the two extremes lies an economically, environment-friendly solution.

In the absence of marine transportation regulatory guidance regarding synthetic fuels, the Coast Guard initiated a risk assessment to evaluate the risk and determine commensurate "standards of care."

The two-day risk assessment evaluated the risk of synfuel to the marine environment as compared to coal, a non-regulated commodity, and oil, a regulated commodity. The risk assessment focused on the marine transportation related (MTR) processes of loading, unloading, fleeting and transporting synfuel. The standards of care, developed by a 25-member workgroup of industry representatives and regulators, will be voluntarily self-imposed by industry to prevent and/or respond to releases of oil-coal synfuels, which sheen in the marine environment. Many of the recommended standards of care are largely in affect throughout the synfuel industry.

The workgroup recommends to the Coast Guard that these standards of care be the genesis of MTR requirements if various synfuel mixtures are determined to be regulated. In the interim, until a determination on synfuel regulation, those companies adhering to the standards of care should expect commensurate consideration when accidental releases occur. Those companies not adhering to the standards of care would likewise receive little or no consideration from COTPs when violations of the Clean Water Act are investigated.

The recommended Standards of Care are:

Loading/Unloading:
- Operating Procedures
- Mooring Procedures
- Use of Deflectors
- Arrangement of Breasting Barges
- Tending Barges
- Reduction of end load on Barge
- Regulate Last Pass Loading Speed

Fleeting:
- Operations Manual

Transporting:
- Draft Management
- Protective positioning of Barges
- Response Plan
- Use of Double Hull Vessels

Incidental Water:
- Disposal at reception facilities in accordance with NPDES regulations

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PROBLEM DEFINITION

The need for a synfuel marine-transportation risk assessment arose due to a lack of guidance from the Federal Government regarding enforcement of the Clean Water Act/Federal Water Pollution Control Act with this product. Because of the lack of guidance, industry was reporting sheens resulting from the secondary effects of the residual synfuel binder, which creates a sheen when the non-regulated product (coal) is accidentally released into the marine environment. As a result, the U. S. Coast Guard took the initiative to establish an expert/stakeholder-working group to develop recommended industry guidelines to prevent and respond to the release of synfuel into the marine environment.

The scope of this risk assessment was limited to those operations that concern the marine transportation of synfuel. The focus was limited to the issues that the Coast Guard may regulate. The intent of the working group was to evaluate the risk of transporting synfuel and develop preventative standards of care that would minimize the impact of synfuel on the marine environment.

The risk assessment process used by the group was a modified version of the 12-step risk assessment developed for the Coast Guard by George Washington University:

1. Identify Experts and Stakeholders
2. Explain Objective of Assessment
3. Obtain Historical data/Reports
4. Analyze Historical Incidents involving Synfuel transportation
5. Define System Variables & States
6. Identify and Categorize Risk reductions (Standards of Care)
7. Identify dominant Incident types
8. Identify dominant Causal factors
9. Identify High Risk States and Scenarios
10. Identify Potential Consequences
11. Evaluate Effectiveness of Risk reductions (Standards of Care)
12. Recommend Standards of Care

The modified Risk Assessment followed the eight steps below:

1. Define the Problem
2. Gather Experts and Stakeholders
3. Identify the Hazard
4. Define System Processes
5. Identify Dominant Incidents
6. Identify High Risk Incidents
7. Evaluate Effectiveness and Cost of possible Standards of Care
8. Recommend Standards of Care

EXPERT AND STAKEHOLDER GATHERING

The working group consisted of consumers of synfuel (power plant operators), transporters (towing/barge companies), producers (synfuel binder and synfuel manufacturers), and regulators (state and federal EPA, NOAA scientific support coordinator, and U. S. Coast Guard). The following persons attended the work group:

Name	Agency	Expertise
Jeff White	American Electric Power	Consumer
Ernie Hugg	East Kentucky Power	Consumer
Delbert Billiter	Kentucky Utilities	Consumer
Edward Hatfield	Ken West Terminals	Producer
Eric Werner	Asphalt Materials	Producer
Jeff Rutherford	Marathon Ashland Petroleum LLC	Producer
John Dubiel	Kanawha River Terminals	Producer
Fred Verardi	Electric Fuels	Producer
Steve Jones	Marathon Ashland Petroleum LLC	Producer
Wade Gilpin	USCG MSO Huntington	Regulator
Sancho Johnson	USCG MSO Pittsburgh	Regulator
Jason Maddox	NOAA	Regulator
Linda Ziegler	US EPA	Regulator
Lyle Bennett	WV DEP/AWR	Regulator
John M. Perkins	WV DEP Office of Water Resource	Regulator
Lincoln Stroh	USCG MSO Huntington	Regulator
Lewis Halstead	WVDEP - Office of Mining & Reclamation	Regulator
Shawn Kubik	Madison Coal and Supply Co.	Transporter
Troy Krebs	MEMCO Barge Lines	Transporter
Bob Taylor	AEP River Transportation	Transporter
Les Grimm	Ingram Barge Co.	Transporter
David Reed	Crounse Corporation	Transporter
Fred Nyhuis	Huntington District Waterways Association	Industry Rep.
Carissa Vandermey	USCG MSO Huntington	Regulator
Bob Hennessy	USCG MSO Huntington	Regulator

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IDENTIFYING THE HAZARD

Synfuel binders are currently being produced using greatly varying proprietary formulas that involve the use of any number of oil and/or chemicals in the process. While these constituents only make up approximately 1-2% of the synfuel, they potentially present some hazard to the environment. For the purpose of this workgroup assessment, the only synfuels that were considered were those created with petroleum-based binders. This decision was made primarily for two reasons. First, the accidental spillage of oil-based synfuels into the navigable water of the United States prompted the Coast Guard to respond to reports of sheens that were being created during the offload of synfuel. A determination needed to be made regarding what action the Coast Guard needed to take given this violation of the Federal Water Pollution Control Act as amended by the Oil Pollution act of 1990 and what standards of care could be used to prevent these accidental spills. Secondly, the determination of the impact of non-petroleum based synfuels was outside the realm of the groups expertise and jurisdiction. As a result, only oil-based synfuels were considered and then further divided into one of two categories based on their make-up and characteristics. These two categories are:

Type 1: Sheening Type 2: Non-sheening

Several key assumptions were made during the hazard identification assessment regarding the two types of petroleum-based synfuels. These include:

- Type 1 synfuel by definition is oil-based and creates a sheen
- Type 2 synfuel is heavy residual petroleum based, and does not create a sheen
- Asphalt used in Type 2 synfuel is the same as what is used in water lines, on roads, and in pond liners, and is a solid at ambient temperature

When making these assumptions, some issues were discussed and agreed upon regarding these two synfuel types. Once spilled into the water, Type 1 synfuel is expected to sink and by definition an oil sheen is expected to be created. The sheen will partially disperse into the water column with some oil reaching the water's surface. The dispersion of the sheen into the water column could effect drinking water supplies in areas of water intakes. The measurable thickness of the sheens produced by the discharge of even large quantities of Type 1 synfuel could not be determined without further testing the material to determine release rates of the oil once the synfuel impacts the water. It was also agreed upon that the sheen being produced by accidental spillage of Type 1 Synfuel was not necessarily a recoverable product and that the best method for dealing with Type 1 Synfuel was to remove the source of the sheen rather than concentrate on sheen removal.

Type 2 synfuel was also expected to sink when spilled into the water but is not expected to create a sheen. It is reasonable to believe that Type 2 Petroleum binder would adhere to the coal for some time. There have been no tests conducted to determine if or under what conditions the binder would be released. Even if released, it was expected to remain on the bottom of the waterway under normal environmental conditions. The

impact of Type 2 Synfuel imposed no greater risk than coal depending on water conditions, recovery rates, etc. The best response to the spillage of synfuel is a quick and efficient salvage operation.

Another hazard that was discussed was the flammability of both types of synfuels. This was conducted to broadly determine if the operation of loading, transporting, or discharging synfuels presented a greater danger of fire than coal. The workgroup determined that the loading, transport, and discharge operations were in essence the same as those of coal and that there was little probability of a coal barge being involved in a fire. The probability of a fire involving a synfuel barge was deemed so low that the issue of risk due to fire was no longer considered.

In conclusion, the hazards of Type 2 Synfuel appeared to be minimal. Type 1 Synfuel creates a greater risk to the environment, than coal, when accidentally released into the water. The proposed standards of care that were developed by this workgroup addressed ways that industry can reduce accidental spills of Type 1 Synfuel into the marine environment and identifies the specific measures that can and/or should be in place to minimize the impact.

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DEFINING SYSTEM PROCESSES

The workgroup first determined the key processes involved in the carriage of Type 1 Synfuel in barges on navigable waterways. While a determination has not been made regarding whether or not oil-based synfuels will be regulated, the workgroup bound the scope of the assessment to these key processes. While synfuel production and handling facilities do not currently fall within the scope of Coast Guard authority or jurisdiction, the decision was made to look at the operations from the standpoint that these facilities could potentially become regulated as marine transportation-related facilities and that various formulas of synfuel could become regulated commodities. That being said, the landside storage requirements for synfuels were not considered by the workgroup. As you will read, the workgroup did focus on several key process events including spill prevention, effective draft management, and emergency response guidelines. The following key processes were chosen:

Key Processes:

- Loading
- Unloading
- Transporting
- Fleeting

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IDENTIFYING DOMINANT INCIDENTS

Following the identification of the key processes, the work group analyzed each of the processes to determine what adverse incidents could reasonably be expected to occur during the operations. The group identified the following incidents that could occur:

During Loading and Unloading:

- Barge breakaway
- Barge fire
- Spillage of cargo
- Wind Spillage
- Allision by another vessel

During Transport and Fleeting:

- Vessel Collision
- Sinking
- Grounding
- Fire
- Allision
- Breakaway
- Rain/incidental water
- Spillage of loose cargo

The risks associated with these incidents were then analyzed to determine their potential frequency and environmental impact, relative to coal and oil.

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IDENTIFYING HIGH RISK INCIDENTS – FREQUENCY AND IMPACT

For the purposes of this risk assessment, risk is a combination of frequency and impact. The frequency is determined using Table 1. The table was used by the workgroup as a general reference for qualitative analyses to help delineate between frequency categories; the average number of transits or cargo operations is a rough approximation.

Table 1

Frequency Categories		
Category	Average number of barge transits or cargo operations between incidents	Description
1	Greater then 10,000	Not Probable – Not likely to occur, assume it will not happen
2	1,000 to 10,000	Very Unlikely – Possible, but not expected to occur more than once in the lifetime of the vessel or facility
3	100 to 1,000	Unlikely – Expected to occur no more than once in the lifetime of a vessel or facility
4	10 to 100	Likely – Expected to occur once or more in a year
5	Less then 10	Very Likely – Expected to occur once or more in a month

Frequency can be defined as the average time period between occurrences. For this risk assessment process, frequency was based on the number of barge transits and cargo operations that occurred between each incident.

Impact is determined relative to the impact of coal and oil; coal providing the lower bound and oil providing the higher bound. See Figure 1 below.

Figure 1

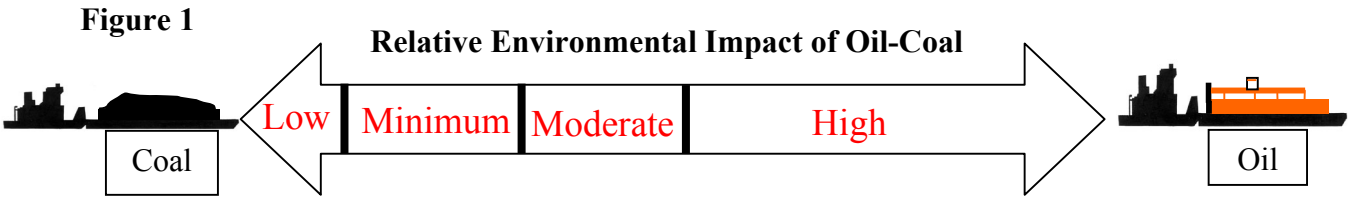

Figure 1 was used by the workgroup in the risk assessment process when evaluating the potential impact of Type 1 Synfuel spillage into the water during the loading, unloading, fleeting and transporting processes. Qualitative terms (i.e. low, minimum, moderate, high) were needed to represent this spectrum of potential impact for the analysis. Coal is

an unregulated cargo, which poses no threat of pollution or harm to the marine environment. This was considered the baseline (low) for comparison purposes.

Oil on the other hand is a regulated commodity, which can produce adverse effects upon the environment and can produce a visible sheen on the surface of the water. A barge load of Type 1 Synfuel made with a quantity of petroleum would not pose an equivalent threat to the environment of the same amount of free oil discharged at the same location. The potential impact of a Type 1 Synfuel spillage into the water is considered by most to be like that of a coal spillage plus a visible sheen. Recovery of an oil sheen is generally not practical, and in some circumstances not even a violation of federal laws (e.g. a sheen produced by a properly operating 2-cycle engine.) Thus, the term "high" used in this comparison relates to the impact that an oil sheen would have upon the marine environment, rather than to the potential damage caused by a medium or large oil spill when oil recovery is likely.

Tables 2 and 3 summarize the workgroup's evaluation of the dominant incidents using the frequency and impact scales found in Table 1 and Figure 1.

Table 2

During Loading and Unloading		
	Frequency	Environmental Impact of Type 1 Synfuel
Fire	1	Moderate
Breakaway	2	Moderate
Spill*	5	Minimum
Allision	1	Moderate
Windage	5	Less than Minimum

* Highest Risk Incidents to be evaluated in next section.

Table 3

During Transport and Fleeting		
	Frequency	Environmental Impact of Type 1 Synfuel
Spillage of loose cargo	3	Minimum
Breakaway*	3	Moderate
Collision/Allision*	3	Moderate
Sinking	2	Moderate
Grounding*	2	Moderate
Fire	1	Moderate
Incidental Water*	5	Minimum

* Highest Risk Incidents to be evaluated in next section.

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The riskiest incidents were chosen as those that occur at the highest frequency (5) and with minimum impact (Spills and Incidental Water) or those that occur at a moderate frequency (3) and have a moderate impact (Breakaway, Collision, and Allision). The workgroup also decided to look at groundings (beyond "bump and go" groundings as defined by Coast Guard District Eight Policy) even though their frequency was lower (2). Groundings were grouped in with collisions and allisions because they too precipitate sinkings. It was felt that the prevention and mitigation measures for collisions and allisions would also apply to groundings.

It should be stated that the term "high risk incidents" is relative to the scope of this assessment. The highest risk incidents, chosen in this section, were evaluated to determine prevention and mitigation measures that can be made into Standards of Care, in the next section, for the marine transportation of Type 1 Synfuel.

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EVALUATING EFFECTIVENESS AND COST OF POSSIBLE STANDARDS

The next step in the process was the evaluation of the effectiveness and cost of possible prevention measures for the highest risk incidents from the last section. Effectiveness and cost determinations were qualitative estimates by the workgroup. The determinations were derived from their professional experience. Table 4 is the list of possible standards of care derived by the workgroup for the prevention of spills during loading and unloading.

Table 4

Spill Prevention during the Loading and Unloading		
	Effectiveness	**Cost**
DOI/Loading procedures	Low	Low
Required Communication	Low	Low
Minimum Coaming Height	Moderate	Moderate
Loading Speed – last pass	High	Low/Moderate
Mooring Standards	High	Low
Barge Tender (towboat)*	High	High
Barge breasting	High	Low (channel width dependent)
Rotary Unloader	Moderate	High
Clam Shell Ops: • deflector/skirts (unloading) • reduce loading at end of barge without reducing total loaded	 High Moderate	 Low Low

* Barge tending for Type 1 during certain environmental factors

Table 5 is a list of possible standards of care derived by the workgroup for the prevention of breakaways during fleeting operations.

Table 5

Breakaway Prevention during Fleeting		
	Effectiveness	**Cost**
Fleet maintenance (Ops manual)	High	Low
Constant Surveillance (Type 1 Synfuel barges to be treated similar to a regulated tank barge)	High	Moderate

Table 6 is a list of possible standards of care derived by the workgroup for the prevention of allisions, collisions and groundings during transport.

Table 6

Allision/Collision and Grounding Prevention during Transport		
	Effectiveness	**Cost**
Draft Management	High	Low
Protective Positioning of Barges	High	High (not practical in some cases)
Carry Response Equipment*	Low	Moderate
Double Hull	High	Low **
Response Manual	Moderate	Moderate/High
Construction/Inspection Standards	Low	High

* Response equipment on towboats is only feasible for mitigating small deck spills. The amount of equipment is equivalent to the American Waterways Operators Responsible Carrier Program requirements.

** Low cost for those hopper barges without drainage systems to voids

Table 7 is a list of possible standards of care derived by the workgroup for the prevention and mitigation of incidental water during transport and fleeting.

Table 7

Prevention/Mitigation of Incidental Water during transport and fleeting		
	Effectiveness	**Cost**
Covered Barges	High	High
Dedicated Service	Low	High
Disposal at Reception Facilities	High	High
OWS	High	High
Vessel Certification	Moderate	High
Coaming Height Requirements	Low	High

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RECOMMENDING STANDARDS OF CARE

The possible standards of care that the workgroup developed in the last section were reviewed to determine if they were reasonable, whether or not they would protect the environment, and whether they would be cost prohibitive. These things considered, the group decided on several "reasonable" standards of care for the loading, fleeting, transport, and unloading of synfuel from barges. The standards of care that industry will strongly consider imposing upon themselves and are recommended to the Coast Guard are as follows:

Loading/Unloading:

- Operating Procedures
- Mooring Procedures
- Use of deflectors
- Arrangement of breasting barges
- Tending barges
- Reduction of end load on barge
- Regulate loading speed – last pass

Fleeting:

- Operations Manual

Transporting:

- Draft management
- Protective positioning of barges, as practical
- Use of double hull vessels
- Response manual

Incidental Water:

- Disposal at reception facilities in accordance with NDPES regulations

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DEFINING THE STANDARDS OF CARE

The workgroup took the time to further develop some specifics for these standards of care. The specifics that were agreed upon by the workgroup will ensure consistency throughout industry with regards to implementation. These include:

Loading and Unloading

Operating procedures will be considered for Type 1 synfuel loading and unloading operations. The procedures should be written, posted and used to train barge loaders, unloaders and other persons that may be involved in these operations. The operating procedures should include:

- Barge mooring and tending procedures
- Training requirements for personnel
- Critical stages of transfer including last pass speed
- Pre-loading inspection requirements
- Use of deflectors between barge and shore to catch spillage
- Notification and report requirements
- Pollution Discharge information
- Vessel monitoring requirements
- Environmental factors
- Response resources and organization
- Equipment checks
- Load speed considerations
- Use breasted barges when possible to prevent outboard spillage

Fleeting

Type 1 Synfuel barges should be fleeted in permitted fleeting areas that have active fleeting operations manuals. An operations manual is currently required by the U.S. Army Corps of Engineers for most fleeting areas on the Western Rivers. These manuals should suffice for meeting the standard of care for fleeting synfuel barges. The manuals should include information on:

- Fleeting area dimensions
- Required lighting of barges
- Mooring arrangements requirements and limitations
- Inspection intervals
- High water procedures
- Ice formation and debris build-up
- Leaking barges
- Spill and breakaway notification

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Transporting

Standards of care for transporting Type 1 Synfuel includes using effective draft management, providing protective positioning of barges in the tow, using double hull barges as the accepted carriage standard, and having response plans.

- Effective draft management is crucial to ensuring a safe transit on Western Rivers. The proposed standard of care for transporting Type 1 Synfuel includes several ways that industry can ensure they maintain proper vessel draft while towing these barges. These include:

  - Towboat captains/pilots to check upper and lower gauge readings prior to pool transit.
  - Vessels will maintain at least 3" under keel clearance as required by USACOE at the locks.
  - Real-time water depths should be used.
  - Barges can be loaded above a 9' draft, as adequate water depths permit.

- When practical, synfuel barges should be placed in a protected position in the tow to minimize the risk of damage to the barge during collisions and allisions. This is not always practical but should be considered whenever possible.

- The use of the current fleet of double-hull hopper barges should be the accepted standard for carriage of synfuels. The hoppers should be sealed to meet the recommended standard.

- Industry representatives recommend as a standard of care, the development and implementation of a company-wide response plan to address synfuel spill response issues. Specifically, the following areas will be addressed:

  - Available response resources
  - Emergency response procedures
  - Spill notification requirements
  - Response guidelines (to include response timelines). These guidelines will focus more on the need to retrieve the product from the water as soon as possible vice sheen recovery, since oil in the form of sheen is virtually non-recoverable.

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CONCLUSIONS AND RECOMMENDATIONS

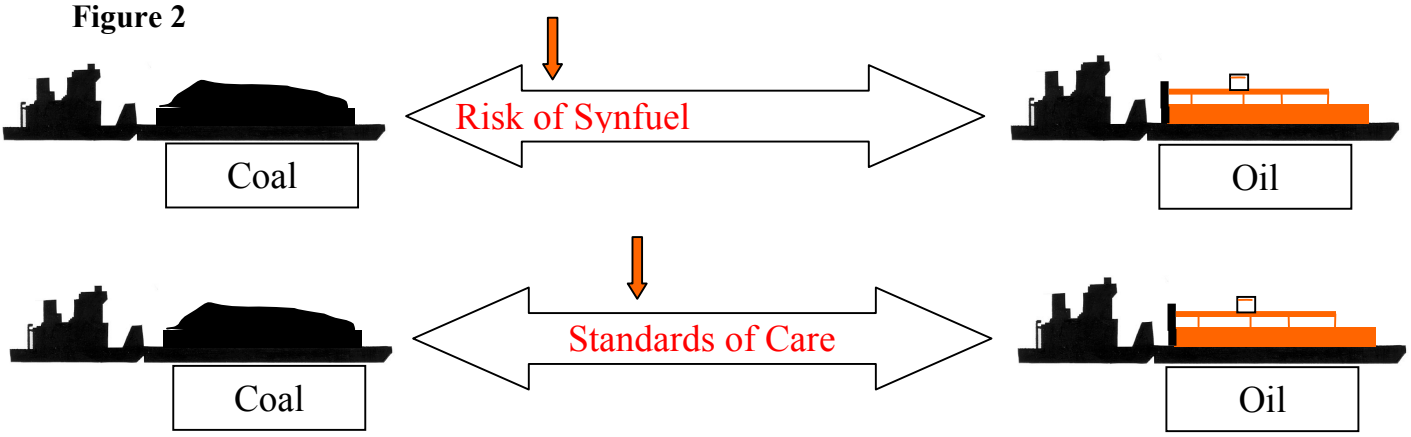
The efforts of the workgroup focused heavily on the petroleum-based, sheening synfuel coal (Type 1 Synfuel). The standards of care that the workgroup recommends would apply to Type 1 Synfuel. The petroleum based non-sheening synfuel coal (Type 2 Synfuel) poses no more of a threat to the environment than coal, a non-regulated cargo. Therefore, additional standards of care for Type 2 Synfuel were not developed or recommended.

The workgroup's recommended standards of care would minimize the risk of accidental spillage of Type 1 Synfuel or the accidental release of incidental water from transporting this cargo. These efforts are focused in four major processes in handling Type 1 Synfuel coal. They are the loading and unloading process, disposal of incidental water, fleeting arrangements, and transporting practices. Many of these standards of care are in place within industry, but have not been formally standardized or been implemented as preventive measures for reducing risk to the environment when transporting Type 1 Synfuel.

A stakeholder group should further develop the standards of care found in this report and develop a guidance document for handlers of Type 1 Synfuel. This document would then be distributed to the major producers, transporters, and consumers of the product as industry best practices and guidelines for preventing accidental spillage of Type 1 Synfuel. As industry implements and adopts these standards, appropriate consideration should be given by appropriate authorities to any entity which by some circumstance violates the Federal Pollution Water Control Act while handling Type 1 Synfuel.

The risk assessment made it apparent that the risk associated with Type 1 Synfuel is only slightly greater than that of coal. The workgroup also determined that the recommended standards of care were quite robust and far above those for coal. With this conclusion, the workgroup recommends that the proposed standards of care be voluntarily self imposed by industry for the handling of Type 1 Synfuel.

Figure 2



STAKEHOLDER REVIEW PANEL

The conclusions and recommendations by the workgroup have been reviewed for accuracy, content, and context by a panel of stakeholders from the working group. The panel consisted of the following persons:

Jeff White	Consumer
Fred Nyhuis	Industry consultant
Ed Hatfield	Producer
Eric Werner	Producer
David Reed	Transporter
Linda Ziegler	Regulator

The panel provided the following comments:

The Coast Guard is commended for their leadership and concern with respect to the loading, transport, and unloading of synfuel. Marine Safety Office Huntington has proactively sought input from industry stakeholders within their area of responsibility that depend upon the opportunity to serve the businesses and citizens for their livelihood. These businesses engaged in river transport are equally concerned with protecting the marine environment and willingly participated in this working group to strike a balance between these goals. We believe that the recommendations contained herein are fair and we strongly recommend their adoption by all operations involved with the transport of Type 1 Synfuel.

However, we also support that these recommendations are not mandated by any regulatory agency without further investigation. The experiences that industry members gain as they voluntarily adopt the recommended procedures will no doubt result in needed revisions to these practices, revisions that cannot be foreseen during a two-day workshop but that require actual field experience. As the Coast Guard and industry share a history of beneficial communication on issues of concern, we expect that revisions and/or new standards of care will be adequately communicated during normal interactions. At some time it may be appropriate to reconvene the stakeholder group to formalize new recommendations into the accepted standards of care.

While the public notice process used for issuance of federal and state regulations provides all concerned parties with the opportunity to voice their concerns, development of any synfuel regulations would be deficient without representation of industry producers, carriers, and consumers of this product. The expertise of these groups would be beneficial to the crafting of any language used to regulate synfuel, as was evident during the workshop conducted by Marine Safety Office Huntington. Industry respectfully requests the opportunity to be a part of any future regulatory developments of any coal synfuel product.

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