Imbiber Beads® AAT™
RE-DEFINING ENVIRONMENTAL SOLUTIONS

Monday August 8th, 2016

To: Eric Mosher, Co-Chair US EPA RRT 2 & Joe Boudreau, Co-Chair USCG/EPA RRT 2
Reference: Imbibitive Technologies' "Case Study" Presentation on Friday April 15th, 2016 at West Point, NY – RRT 2 Meeting.

Subject: **An Open Letter to All RRT 2 Participants**

Gentlemen,

Thank you for allowing Michael Iafrate and I to present our Case Study on the Texas City/Houston Ship Channel "Y" Oil Spill that took place in March 2015. The purpose of the Case Study was/is twofold:

- To illustrate the shortcomings of the current oil spill response regime and,
- To promote the use of oil-sensitive, super-absorbent polymers (SAPs) as a means of improving the performance and recovery of spilled oils and chemicals.

On behalf of Michael, myself and Imbibitive Technologies I commend you for your forward-thinking and consideration of looking for ways to improve the performance of the oil spill response industry.

What appeared to get "***lost in translation***" during and after the presentation is that the use of super-**absorbent polymers (SAPs)** is not intended to replace the current array of equipment but to improve its' efficiencies.

I am aware that an amount of discussion took place between yourselves and several of the meeting attendees, more especially the representatives from Hudson Riverkeepers, concerning the incorporation of Imbiber Beads® into spill contingency plans by RRT 2.

It is my understanding that an amount of push-back from RRT 2 was evident and the issue of "proving" the technology was raised, placing the onus squarely upon IMBTEC to accomplish this. Similarly, the comment that EPA neither recommends nor endorses products was also made known to the group.

With respect to "proving the technology" I have attached a number of third-party testimonials as to the effectiveness of Imbiber Beads® for the purposes discussed, for your review (See Appendix A).

I raise the issue that based upon past historical and well-documented statistics the current array of technologies being employed by the global spill response industry to remove significant volumes of spilled oil from the environment has failed miserably, and continues to do so.

In spite of the statistics and repeated demonstration of the ineffectiveness of the equipment and techniques being used over the past thirty years or more, EPA/USCG/NOAA are in fact condoning the continued use of this equipment and techniques and in doing so are also condoning the maintenance of the status quo when it comes to spill mitigation.

With this issue in mind I also raise the concern that there is absolutely no reason for an OSRO to utilize Imbiber Beads® technology even if IMBTEC were to prove beyond any doubt that it represents a superior alternative to those technologies currently being used within the spill response industry.

My point is that without "**measurable performance criteria**" on which to base the performance of an OSRO there is no need for OSROs to change the way they respond to oil spills. As has been stated previously, OSROs are compensated regardless of how much oil they remove from the environment, and as the system currently exists there is no means of measuring their performance.

As the gatekeepers for the US environment it is EPA/USCG/NOAA's mandate to protect the environment and enforce the regulations that are in place. It is assumed that the purpose of the RRTs and the NRT convening on regular occasions is to look for ways of better coordinating response operations and improving their outcome.

The irony in this is that the inability of EPA or USCG to dictate what techniques or products should be used in a given situation means that both EPA and USCG are entirely dependent upon the OSRO and its contractors as to how the incident is dealt with.

As far as IMBTEC is aware EPA/USCG/NOAA continues to advocate "mechanical removal" of spilled oil from the environment as its first mitigation option of choice. With the inordinate amount of research being conducted on effects and behaviour of dispersant-treated oil versus research into improved recovery techniques and equipment it is not difficult to understand how much influence the oil industry is having upon this EPA policy.

Years after the Macondo/DWH catastrophe reports continue to surface from various research institutes of the damage done to the GOM ecosystem as a result of the extensive use of dispersant used both on the surface and at the wellhead during the response operation. The most recent findings from NOAA and Researchers at the University of Illinois Urbana-Champaign reporting increased mortality rates of the dolphin population living within the footprint of the oil spill from 2010 – 2014.

Amendments to the 2013 Edition of the USCG OSRO Classification Program state that OSROs must be able to demonstrate an ability to utilize dispersants as part of the certification criteria. This is nothing less than an endorsement of dispersant use by a Federal Agency regardless of whether the actual name of the dispersant is used or not. Everyone within the industry is aware that Corexit 9500 was approved for use during DWH by EPA and as such is the product of note whenever dispersants are to be used. The incestuous relationship between BP, the oil industry and Nalco ensures that Corexit 9500 will be used on future oil spills due to EPA's previous approval for use.

The dramatic increase in the focus upon shoreline clean-up is testimony that the current array of equipment and techniques being utilized during the initial phase of a response operation is not very effective. Add to this the fact that the dispersant used during DWH did not prevent oil from coming ashore, and it is little wonder that SCAT has become an integral part of the process.

Steve Lehman (NOAA) made the comment during the meeting that if the initial response was more

effective then the extensive amount of research into the effects and behaviour of oil and its long-term impact upon the marine environment would not be as necessary.

Accordingly, use of dispersant is the only "fast-attack" method currently being utilized that addresses the 1990 OTA issue of the slick reaching unmanageable proportions within hours of the event. The problem is that dispersant is not a "removal" technology and goes counter to the EPA's current spill response philosophy. The oil industry likes it because it allows response activity (versus recovery activity) to commence as soon as the plane can reach the spill site.

In spite of this evidence EPA continues to insist that it does not recommend or endorse products or technologies.

As you may be aware the "modern" concept of utilizing **Best Available Technology (BAT**) concerning oil spills was first introduced in 1992 (OSPAR Conference, Paris, France) as a means of protecting marine environments within the North Atlantic Ocean.

Coincidentally, the concept of utilizing BAT has been an important consideration of the US Clean Water Act since 1972, and prescribes that the best state of the art technology be employed without regard for traditional cost-benefit analysis; the criteria for use being outcome-based.

From the CWA "...***shall require application of the best available technology economically achievable for such category or class, which will result in reasonable further progress toward the national goal of eliminating the discharge of all pollutants***"

The push-back by environmental and special interest groups to oil industry expansion through off-shore, pipelines, road & rail transport expansion is well-founded based upon the industries' performance (or lack of performance) over the last thirty – forty years.

The inability of EPA/USCG/NOAA to dictate and enforce that **Best Available Technologies** be used during spill events has effectively hamstrung any opportunity to advance the state-of-the-art from where it was thirty, forty or even fifty years ago.

Use of Best Available Technology initially was more concerned with the ultimate "outcome" of a marine pollutant discharge and how best to deal with it under the auspices of the Clean Water Act. Since first considered as a concept BAT includes what is "reasonably achievable" along with what is practical.

The Case Study presented during the RRT 2 Meeting in March 2016, illustrated that the cost of employing BAT with respect to Imbiber Beads® use on oil and chemical spills represents genuine "value" versus what passes for the popular (widely accepted) spill response technologies used by OSROs. The benefits of being able to recover significant volumes of spilled oil are obvious yet there is no reasons for an OSRO to employ BAT. Why?

By insuring the use of Best Available Technology during oil and chemical releases and by referring to Imbiber Beads® as oil-sensitive, super-absorbent polymers versus their brand name EPA/USCG/NOAA can recommend their use in accordance with ASTM International "Performance Standards and Definitions"

and avoid the risks associated with recommending or endorsing any particular product. (This is in accordance with OMB Circular 119-A re: National Technology Transfer & Advancement Act 1995)

Misguided or misinformed? – Since being introduced to the spill response market over forty years ago response contractors have continued to trot out the old "chestnut" that oil-sensitive SAPs, such as Imbiber Beads®, are simply "too expensive" to use on oil and chemical spills in comparison to so-called traditional sorbents such as mb-pp. Contractors will use bale after bale after bale of sorbent pads and booms in an attempt to clean-up spills, knowing full-well that their use is more cosmetic than effective, yet results in billable products and the ensuing hours (time & materials).

The reality is that the use of Imbiber Beads®, whether in bulk particulate form or in value-added form (i.e. booms & blankets) represents true value and eliminates the need for a lot of the ancillary operational and equipment costs associated with typical response operations. More effective response operations in the early stages of a spill event will dramatically reduce the amount of time and money needed for costly, time-consuming shoreline clean-up, which has become a mainstay of the spill response industry.

That the issue concerning "conflict of interest" for a contractor to use less effective means to clean-up a spill never seems to be addressed.

The numbers for the Case Study presented do not lie. The benefits of using oil-sensitive SAPs are so obvious as to raise the question as to why there is so much resistance by the industry to consider anything "outside the box", and at the very least to consider their use?

In comparison to polypropylene pads, for example, the superior performance benefits of SAPs are obvious both from a cost-effectiveness perspective and with respect to their overall efficacy there is no comparison.

Capture & Containment – The absorption (imbibition) process is "absolute" and unlike typical sorbent pads where the liquid is simply held in discrete droplets within matted polypropylene fibers, (ready to re-release their contents as easily as they picked them up) SAPs eliminate the liquid phase and the spilled liquid is completely contained. (There is no secondary contamination of personnel or the environment, which is a problem that anyone who has tried to pick up a spill using mb-pp is all too familiar with).

As has been discussed in earlier correspondence the primary issue historically concerning effective spill response operations for bluewater spills is a logistical one; that the spill spreads to unmanageable proportions before the response operation can mobilize and arrive on-scene. The Office of Technology Assessment made reference to this in their report (Coping with an Oiled Sea) to Congress in March 1990, one-year after the Exxon Valdez that an oil spill "will spread six square miles within the first twelve hours with little wind or current assistance".

The oil spill response industry continues to ignore this critically important item; that of preventing the slick from spreading to unmanageable proportions within the first few hours of any spill event.

In fact, and for the benefit of the RRT 2 Group, the International Tanker Owners Pollution Federation (ITOPF) identified this issue in their paper entitled "Factors that Determine the Costs of Oil Spills",

presented at the International Oil Spill Conference, and held in Savannah, GA in 2003 – ***"An active response is therefore often adopted even when technical opinion is agreed that it is unlikely to have a significant benefit. This is usually due to the fact that oil spilled on the surface of the sea spreads rapidly, thereby extending over an area that is too great to be countered effectively by available techniques. Added to this are the limitations on containment and collection systems imposed by winds, waves and currents and the severely reduced effectiveness of chemical dispersants on high viscosity oils and water-in-oil emulsions (mousse). Responding in such circumstances can lead to high cleanup costs for little or no benefit in terms of mitigating the oil's impact on coastlines and sensitive resources".***

So in spite of the industry identifying that an oil spill will spread so rapidly that effective mechanical recovery is not possible, that the benefits of mounting a response operation are minimal relative to the cost; the industry and those government agencies responsible for safeguarding the environment choose to maintain the status quo of the past thirty years by continuing to utilize the same ineffective equipment and tactics.

One can only assume that the "justification" for allowing this to happen is due to the belief that there are no technologies available that can change the outcome? The outcome is therefore a foregone conclusion:

- The OSRO will mobilize and head for the spill site.
- The slick will spread to unmanageable proportions.
- Trajectory models will be employed in an attempt to identify where the oil is headed.
- The OSRO will deploy skimmers and booms in an attempt to recover the oil.
- Miles and miles of next to useless inflatable booms and sorbent booms will be deployed in an attempt to protect eco-sensitive areas near-shore and on-shore.
- The oil will start coming ashore.
- The local environment will be impacted.
- The local economy will be impacted.
- The Responsible Party and their underwriters will be billed excessive amounts relative to the volume of oil actually recovered.
- The Responsible Party will be fined for damaging the environment in contravention of the Clean Water Act.
- A report of the incident will be written with a section entitled "Lessons Learned".

(Compounding the problem of "mechanical recovery" is the increased acceptance upon dispersant and their negative impact upon skimmer effectiveness).

The implications of allowing the spill to spread impacts upon the success of the entire response operation; rendering skimmer equipment ineffective due to the relative thinness of the oil layer in accordance with its rated capacity and soiling miles of coastline requiring costly shoreline clean-up and mitigation.

As a result, and as was illustrated during the **Texas City "Y"** spill the oil was allowed to migrate miles downstream away from the collision site and inundate several hard to reach, eco-sensitive areas.

A spill of 168K gallons that could have been cleaned-up within hours of the incident occurring, had adequate inventories of equipment and inventory been strategically located took instead thirty-three days at a cost to the spiller of $125 Million. (This does not take into consideration the additional demurrage cost of $325 Million per day over the three days the Houston Ship Channel was closed down).

As an "**Alternative Response Technology**" concern was expressed during the Q&A period about the use of oil-sensitive, super-absorbent polymers for the purpose described. The concerns ranged from "proving the concept" to "how to recover the imbibed oil" to "toxicity" of the SAPs to marine life as examples.

Discussion also centered around the fact that the only Alternative Response Technologies currently being considered are oil disposal technologies such as in-situ burning and increased use of detergent to break the slick up and suspend it deeper into the water column.

The decision of where dispersant can be used must also be given serious consideration and in very many instances dispersant will not be used, which means that the response operation must rely upon the same mechanical recovery equipment and techniques that result in costly, time-consuming and damaging operations similar to that illustrated by the Texas City "Y" Case Study.

As has been stated in previous correspondence IMBTEC is not aware of any measurable performance criteria being in place when it comes to spilled oil recovery?

The 2013 USCG OSRO Classification guidelines further note that while classification provides a good indication of an OSRO's response capability, simply being a Coast Guard-classified OSRO does not **guarantee performance** during an actual spill. In this regard it should be remembered that the response plan regulations also include the following caveat: **"The specific criteria for response resources and their arrival times are not performance standards.** They are planning criteria based on a set of assumptions that may not exist during an actual oil spill incident."

As a result the assessment of the success of any response operation is purely subjective, which is why in our opinion the spill response industry continues to drift along and maintain the status quo i.e. recovery statistics have remained at 10 – 15% over the last thirty years.

Meaning no disrespect but the fact that Federal OSCs are on-site is more or less meaningless when it comes down to the effectiveness of the recovery operation; the statistics support this contention.

What is the point of having an OSC oversee the deployment of skimmers and other ancillary equipment that has very little, if any chance of actually recovering significant volumes of spilled oil?

Ensuring that the OSRO is in compliance with regulations that are outdated and ineffective is as cosmetic as the response techniques that are currently being used, and will continue to be used unless changes are made to the mindset and requirements for effective oil spill recovery.

As has been stated in earlier correspondence, one of the world's largest OSROs made the comment to IMBTEC that "relative to the cost if it is simply better for the environment to use Imbiber Beads® on a spill, it is not sufficient incentive for their use".

That the OSRO is not required to consider the use of Best Available Technology where applicable goes counter to the entire concept of BAT.

The perception that use of Imbiber Beads® on an oil spill will significantly increase the cost of the response operation is a myth promoted by the OSROs that has absolutely no basis of support or evidence. That none of the OSROs has conducted any tests, trials or demonstrations or recorded any results or cost-analysis as a result of employing Imbiber Beads® on a spill over the past thirty years raises the question of where this perception came from, and what the motive is for continuing to promote this myth?

The Texas City "Y" Case Study clearly denotes that the use of Imbiber Beads®, whether in particulate form or in value-added products such as booms and blankets represents a significant cost-savings and provides the means to recover significant volumes of oil.

During the Q&A the group voiced their concern that use of SAPs may not provide the positive results anticipated; the assumption being that their use may negatively impact the outcome. This is an interesting concern in light of the ineffectiveness of the current array of technologies being employed.

(The question that begs to be asked is "how much more damage to the GOM ecosystem would have occurred if the reported 3% of the oil recovered during DWH had not been recovered"?)

The increased acceptance of dispersant use and reference to Corexit 9500 is a direct result of EPA permitting the use of 800K gallons of dispersant at the wellhead, for the first time in history, during DWH. The long-term implications of its use were not known at the time and the legacy of that decision is still being written. Research currently being funded deals primarily with dispersant use and its impact upon the behaviour and effect of oil upon marine life and shorelines.

The fact that EPA authorized such extensive use of dispersant during DWH was in effect perceived as an endorsement by EPA for the use of dispersants even though EPA tries to claim otherwise. The inordinate amount of research on the effects of dispersant use on oil spills is testimony to this. Dispersant was seen as the only option available at the time for trying to lessen the impact of the oil coming ashore.

To the best of our knowledge there is no work being undertaken on actually improving oil spill recovery methodologies?

During the meeting Capt. John Lipscomb of Hudson Riverkeepers asked why the fast-attack system advocated during our presentation has not been put into place. Capt Lipscomb referenced that the Region had just received a $3.5 Million fast-boat for emergency response operations, complete with all of the ancillary equipment described within our presentation. His question was why isn't the Region stocking SAPs for the purpose described, especially since the Region recently equipped several response trailers?

Accordingly, the reluctance of those involved directly in spill response (OSROs) to utilize SAP technology when dealing with oil, fuel and solvent releases stems primarily from two misconceptions. The first misconception is that their use is 'too expensive" in comparison to traditional methods; traditional methods that have repeatedly demonstrated their inability to recover significant volumes of spilled oil.

The Case Study illustrated that the Texas City "Y" Spill cost the Responsible Party and its underwriter about $7K per gallon (Response Operation cost = $125M), while the fast-attack system promoted by IMBTEC works out to less than $50 per gallon, (Total cost = $2.5M) and calculates that upwards of 100% of the oil is recoverable.

The second misconception is recovery of the imbibed oil will be too difficult.

The simple counter to this argument is to promote the use of Imbiber Beads® contained within "blankets", which can be retrieved at the most convenient and cost-effective time. Tests have shown that each blanket will "capture and contain" two-gallons of crude oil, which means that for a spill of 168K gallons it will require 84K blankets at a cost of $50/blanket or $4.2M to pick-up all 168,000 gallons of oil. Even at $25 per gallon it is a long way to the $7K per gallon the spill actually cost the RP.

As was discussed, the **absorption/imbibition process is absolute** as the oil, fuel or solvent becomes an integral part of the SAP's structure and is no longer available for re-release upon retrieval; something that cannot be said of typical polypropylene pads and booms yet the response industry continues to utilize sorbent products that are of dubious benefit. Why?

The prolific continued use of polypropylene sorbent products versus oil-sensitive SAPs is not unlike the personal hygiene industry insisting upon the continued use of cloth diapers in spite of the overwhelming advantages exhibited by disposable diaper technology. As was demonstrated repeatedly the performance and convenience of disposable baby diapers overcame any perceived cost increase from that of cloth diapers.

Similarly, like cloth diapers polypropylene sorbents leak their contents with simple gravitational pull or will re-release an amount of their contents in the presence of water.

In addition, the increased exposed surface area of polypropylene sorbent products increases the "rate" at which hazardous vapors are released and consequently "**lowers**" the flashpoint; a serious consideration during any spill event involving aromatic hydrocarbons. (This is also a significant consideration when noxious aliphatics such as diesel fuel are involved).

Concern has been expressed on numerous occasions about the increased risk of fires and explosions due to the high aromatic content of Bakken Crude Oil and Diluted Bitumen. Tests have demonstrated the ability of oil-sensitive SAPs to not only permit clean-up of a spill of these materials to occur but also "**raises**" the flashpoint and lowers the concentration-in-air to below LEL in many instances.

The group was informed that the State of New York DEC, as part of the Area Contingency Plan has $2.1M for purchasing spill response supplies and is outfitting several response trailers for that purpose.

Similarly, the group was also informed that NOAA has prepared a Fast-Attack Response Guide for Bakken Shale Oil and for DilBit. RRT 3 LEPC released a similar guide back in June 2015.

The overwhelming message concerns the flammability/volatility issue of both oils. Vapor-suppressing foams are recognized as an important mitigation tool but there is no mention of how "eliminating the liquid phase" of organic liquids has demonstrated the ability of oil-sensitive, SAPs to lower the "rate" at which hazardous vapors off-gas to the point of reducing the concentration-in-air to below LEL.

Testimonials as to the effectiveness of Imbiber Beads® in eliminating the liquid phase and thereby lowering the concentration-in-air to below LEL are listed in Appendix A of this letter. The most extensive work in demonstrating the effectiveness of Imbiber Beads® to reduce the concentration-in-air of hazardous vapors was conducted by the Maritime Disaster Prevention Center (MDPC – Yokohama, Japan) from 2001 – 2007.

NOTE: Conversely, sorbent products such as **melt-blown polypropylene**, which are widely used and accepted by government and industry as part of the response industry's standard operating procedures, increase the exposed surface area, lower the flashpoint and increase the concentration-in-air of potentially explosive and flammable vapors. This occurs because the oil is still available in discrete droplets after the sorbent product is applied and is merely filling void spaces between matted polypropylene fibers.

Net Environmental Benefits Analysis

We are all aware the outcome of every oil spill since the Exxon Valdez, twenty-seven years ago, has been exactly the same and that the same equipment and techniques employed twenty-seven years ago are pretty much the same equipment and techniques used today.

Accordingly the term NEBA gets interjected into oil spill operational response and mitigation analysis after each and every event.

NOTE: What exactly are the environmental benefits of failing to recover 85 – 90% of any oil spilled over the past thirty years? Who is the primary beneficiary of this woeful inadequacy of the response operations being employed?

If a **Net Environmental Benefit Analysis (NEBA**) is used for the scenario described above the argument becomes even more compelling.

- Early application of Imbiber Beads® onto an oil spill localizes the spill and restricts the spread of the slick to unmanageable proportions. This in turn reduces the amount of equipment required at the spill site; thereby also reducing the cost of the response operation.
- The closer to the source of the slick the imbibition process is applied the thicker the slick will remain and improve skimming operations; thereby improving the cost per gallon recovered.
- Application of Imbiber Beads® onto the oil eliminates the liquid phase and transforms the oil into a non-sticking, agglomerated mass that can be more easily retrieved using readily available skimmer equipment such as weir skimmers and incline-plane skimmers.
- Elimination of the liquid phase means that the oil is no longer available to coat flora and fauna; thereby minimizing damage to shorelines and minimizing costly shoreline treatment.

- Elimination of the liquid phase means that any "imbibed oil" that happens to reach shore can be "picked-up" as non-leaching, non-sticking chunks of oil thereby shortening the time required to clean-up shorelines.
- Elimination of the liquid phase has also demonstrated a reduction of the "rate" at which hazardous vapours are released. It is the vapours that support combustion and it is the vapours that are toxic when inhaled. This has serious occupational safety and public health considerations where pipelines run through large urban areas and the threat of pipeline failure exists.
- Imbibed oil collected can be taken to a refinery and thermally cracked effectively allowing the oil to be recovered and recycled; thereby "**closing the environmental loop**". (This was proposed by Dr. Richard Hall (The Dow Chemical Company) in 1970)
- Greater volumes of oil recovered means less damage to local ecosystems and less money spent upon remedial activities.
- Greater volumes of oil recovered means less damage to local economies and faster recovery.

Conversely, use of dispersant either suspends the oil below the surface and deeper into the water column where skimmers cannot reach it or thins the oil to the point that skimmers are even more ineffective. Mechanical recovery of oil treated with dispersant is severely impacted.

Couple to this several issues related to toxicity and how oil and dispersant might impact marine life. There is no mention that application of dispersants in the early stages of the response operation, which is when dispersants are most effective, drives high concentrations of the most toxic components of the oil (PAHs, et al) into the water column. Marine life inhabiting depths exposed to the oil/dispersant mix are put at significant risk versus the oil remaining on the surface.

IMBTEC's proposal discusses why recovery statistics remain at Valdez-era number of 10% or less and offers true innovation as opposed to simply re-cycling or modifying the same old tired equipment and tactics.

From IMBTEC's perspective the closest thing the oil spill response industry has to a "fast-attack" spill response system involves the spraying of dispersant onto the slick; trying to lessen the impact of the oil reaching shore. In many instances **disposal technologies** such as in-situ burning and dispersant use is severely restricted, which means there is a decided shortfall in genuine fast-attack response capability, which translates into continued dependence upon mechanical recovery techniques that have demonstrated repeatedly their inability to recover significant volumes of spilled oil.

The HEROS™ Treat & Skim™ System offers the response industry a fast-attack, oil spill "recovery" technology where one does not currently exist.

The HEROS™ Treat & Skim™ System advocates "innovation, ground breaking objectives, novel concepts and approaches". The fact that the oil-sensitive super-absorbent proposed is the only product of its kind in the world also supports that it is "state-of-the art".

As a single-source (one of a kind) product it is necessary to explain the features and benefits of its use in order to dispel any misconceptions and also to explain the implications of its use during a response operation. For example, the discussion of the "swell" ratios, i.e. the ability of the super-absorbent

polymer to pick-up several volumes of liquid for each volume of polymer means that less will be required in order to immobilize and localize the spill. From a logistical perspective this is a critical factor when determining strategic stockpiles and application rates.

Similar considerations are typically calculated for disposal technologies such as dispersants; the primary difference being that the use of oil-sensitive, super-absorbent polymers allows for the oil to be removed from the environment as opposed to being diluted into the water column.

Impact; the societal and environmental impact of actually being able to improve recovery statistics by 400 – 500% (as a minimum stated within IMBTEC's objectives) over existing numbers should be self-evident to anyone reading the proposal. For the sake of clarity the following examples of how this will positively impact local economies and environments will be applicable:

- Being able to recover four or five times the volume of oil currently being recovered will impact directly upon the amount of oil that remains in the marine environment. More oil recovered means less damage to marine life and cleaner water.
- Being able to recover more oil means that less oil will wash ashore, which means that fewer animals living onshore are likely to be affected by the oil.
- Being able to recover more oil means that lengthy, costly and unsightly shoreline cleanup is reduced; thereby allowing faster resumption of shoreline activities and reducing the impact of the spill upon local citizenry.
- Being able to recover more oil means less oil will reside within the water and water column thereby making the water less toxic and safer for marine life.
- Being able to recover more oil means waterborne activities such as fishing, boating, swimming, for example will resume to pre-spill conditions that much sooner and lessen the economic impact of the spill.
- Being able to recover more oil means that damage to local fishing vessels and pleasure craft from oiling will be minimized.
- Being able to recover more oil, minimizing damage to the local economy and environment means that good public relations will be restored that much faster and minimize the workload of public officials, government officials and politicians.
- Being able to recover more oil and then recycle the oil into practical uses benefits every organization involved with the spill.

The impact of being able to accomplish all of the above will have global implications upon how oil and HNS releases are dealt with and promotes the oil industry and EPA/USCG/NOAA as providing leading-edge technology for dealing with marine oil spill events.

Expected Impact:

- **Develop an integrated capacity to optimally respond to major marine pollution events**… The HEROS™ Treat & Skim™ System states that one of its' objectives is to improve oil spill recovery statistics by 400 – 500%, which clearly meets the criteria of optimizing current response capability and instituting measurable performance criteria.
- **Mitigate negative impacts of marine pollution on the marine environment, coastal economies and communities**…The benefits of increased recovery of spilled oil are listed above and clearly meet this criteria; the reasons being self-evident as described above.
- I**mprove the integration between the scientific community and relevant government agencies charged with dealing with pollution**…Government agencies and the scientific communities are concerned with the short and long-term impact of oil spills upon the environment and the local economy. Improved recovery of spilled oil through the use of the HEROS™ Treat & Skim™ System in conjunction with existing spill response technologies will lessen the impact of a spill on both the environment and the local economy. Scientific study will establish how quickly the environment can be restored to pre-spill conditions. Economic study will determine the impact of the spill and subsequent recovery by local industry to pre-spill conditions due to improved oil spill recovery.
- **Reduce risks of the new offshore economy and improve the business environment for future investments**…Common sense dictates that if the impact of an oil spill is lessened then the public is much less inclined to object to new development projects within the offshore industry and less likely to protest increased activity within the sector due to environmental or economic concerns. The oil industry and EPA/USCG/NOAA will be able to demonstrate and assure stakeholders that they have these sorts of concerns well in hand. Currently the public's perception is that the oil & gas industry does not know how to effectively deal with oil spills. This perception will change once the HEROS™ Treat & Skim™ System is implemented and recovery statistics improve.
- **Contribute to the effectiveness of the oil industries operational capacity to respond to pollution from oil and gas installations**…In spite of best intentions and hundreds of millions of dollars worth of investment in spill response equipment, technologies, and training exercises response organizations (OSROs) can only talk in terms of being able to "respond" to oil spills versus their ability to actually "recover" oil spills. Relatively speaking the actual volumes of spilled oil recovered over the twenty-seven years since the Exxon Valdez is tiny; often less than 10%. The reasons as to why the trend continues are explained within the HEROS™ Treat & Skim™ System,, as is the rationale for changing the status quo and adopting a truly innovative approach to the way oil spills are dealt with.

  Simply "responding" to an oil spill is not good enough; OSROs need to be able to demonstrate the ability to "recover" significant volumes of spilled oil not simply demonstrate that it has the capability. In order to effect genuine change the mindset of the industry needs to change; otherwise the status quo will remain and the monies invested will be wasted. The HEROS™ Treat & Skim™ System advocates that it will improve current oil spill regime recovery statistics by 400 – 500% by allowing the response/recovery operation to commence within hours of the event occurring, keeping the slick from spreading and contributing to significant volumes of oil being recovered. Response Organizations around the world continue to look at building bigger, faster skimmers as

the answer to the problem of collecting significant volumes of spilled oil, and continues to fail to identify why faster, bigger skimmers et al cannot compensate for ever-thinning, ever-expanding slicks. The proposal describes in part why this is so, and how the HEROS™ Treat & Skim System addresses the problem.

Improve societal acceptance of pipeline, rail & offshore activities.

- As stated previously the public's perception of the oil and gas industry's ability to effectively cleanup oil spills is that the industry does not know how to cleanup oil spills. The fact that Macondo/Deepwater Horizon oil spill is one of the reasons for investigating and funding innovations to the way oil spills are dealt with is testimony to this (GOM Foundation et al).

  Any innovation that contributes positively to the public's perception that the oil and gas industry has improved oil spill recovery statistics is bound to impact upon their acceptance for increased exploration and development of offshore activities; thereby also contributing positively to the USA and global community's economy. IMBTEC advocates the use of the HEROS™ Treat & Skim™ System for improving the recovery of spilled oil as opposed to relying upon the same equipment and techniques that have been proven more cosmetic than effective over the past twenty-six years since the Exxon Valdez.

IMBTEC welcomes the opportunity to discuss the contents of this letter with all parties interested in improving oil and chemical spill recovery statistics.

Thank you for your interest in what IMBTEC is proposing.

Yours truly,

John S. Brinkman,
President

Appendix A

Testimonials as to the effectiveness of Imbiber Beads®:

US Air Force – Management Equipment Evaluation Program, Eglin AFB, FL

"The Imbiber Beads® performed exactly as the manufacturer stated, absorbed fuels and left the water standing … The ability to capture and contain a free phase liquid is without equal in most cases…"

US Army Engineer School – Directorate of Environmental Integration
Benefits of Using Imbiber Beads®

- *Can be used for a wide variety of active, proactive and passive pollution applications when organic contaminants must be controlled and contained.*
- *Can significantly decrease the amount of material needed to control and contain a spill, and reduce the amount of hazardous waste generated.*
- *Eliminate secondary contamination, which means less labor required, more efficient cleanup, and increased worker safety.*
- *Reduce direct contact with hazardous spilled products (Imbiber Beads® do not need to be wrung out to recover spilled materials as other adsorbents.*
- *Reduce the vapor release rate of dangerous and flammable materials by a factor of 5-6 times that of other adsorbent materials. -*
- *Are hydrophobic and unaffected by water, selectively absorbing organic contaminants from water.*
- *Recyclable as an alternative fuel source in energy recovery processes, lowering disposal costs.*
- *Reduce the amount of spill recovery products purchased, transported and stored.*
- *Reduce the amount of contaminants entering surface water and aquifers as stormwater run-off through use of passive drainage control systems.*

Pacific Environmental Company, Hawaii

"I had the opportunity to use Imbiber Bead Blankets for a response to a gasoline spill at a service station in Kailua, Hawaii. About five gallons of unleaded gasoline had flowed into the storm drain system at the service station. Some of the gasoline had accumulated in the manhole. The sump was about two ft. by two ft. and some four feet below the grating. There was a strong smell of gasoline coming from the sump. The L.E.L. readings were very high. Two Imbiber Bead Blankets were lowered into the sump. The reading in the sump dropped to less than 1% within minutes of the Imbiber Beads being place in the sump. This quickly eliminated the potential for an explosion and allowed us to proceed with the clean up. We have used Imbiber Beads in the past for gasoline spills in an unconfined space; however, this was the first time we had responded when the danger of an explosion was so high. The Imbiber Beads were extremely effective in quickly reducing the explosive vapors. I highly recommend this product to all emergency responders when cleaning up fuel and solvent spill".

ST-Airport Services Pte Ltd, Singapore

"An Imbiber Beads® Floating Boom was subsequently used in a further attempt to resolve the problem. After deploying a single Imbiber Beads® Floating Boom for a continuous period of five weeks during a rainy period we found no visible traces of Jet Fuel downstream of the Imbiber Beads® Boom.

The Imbiber Beads® boom was retrieved at the end of the five week period. We found that it was saturated with a combination of Jet Fuel and bitumen, which had come into contact with the Jet Fuel, but no trace of water, was found.

This incident, coupled with an earlier evaluation of Imbiber Beads® has left us satisfied with the performance of this product. As such we intend to deploy Imbiber Beads® as our frontline fuel spill cleanup and containment product for our bowsers, Bridgers and fuel depots".

2001 – 2007 Maritime Disaster Prevention Center (MDPC – Yokohama, Japan)

Year #1 Test Results featuring Imbiber Beads® effectiveness on Hazardous & Noxious Substance (HNS) vapor reduction (Courtesy of MDPC)

Rank	Chemical Name	Initial Concentration (PPM)	Time Immediate (PPM)	Time 5 min (PPM)	Time 10 min (PPM)	Time 20 min (PPM)	Time 30 min (PPM)	Initial % Change	Final % Change
1	Xylene	700	50	50	50	<50	<50	93%	>93%
2	Benzene	12,000	1,300	960	780	600	540	89%	96%
3	Styrene Monomer	550	55	<55	<55	<55	<55	90%	>90%
5	Toluene	4,100	480	360	360	300	300	88%	93%
6	Cyclohexane	13,000	590	260	220	200	200	95%	98%
12	Methyl Methacrylate	3,700	600	400	400	340	340	84%	91%
15	Vinyl Acetate Mon.	18,000	1,700	910	780	520	390	91%	98%
16	Propyl Benzene	LEL % - 2.0	LEL % - <0.5	LEL % - <0.5	LEL % - <0.5	LEL % - <0.5	LEL % - <0.5		
21	Butyl Acrylate	390	<65	<65	<65	<65	<65	83%	>83%
22	Ethyl Acetate	20,000	1,100	770	440	330	<110	95%	>99%
23	Normal Hexane	11,000	1,200	660	500	390	330	89%	97%
24	1-Octane	LEL % - 24.0	LEL % - 2.5	LEL % - 2.0	LEL % - 2.0	LEL % - 2.0	LEL % - 2.0		
25	Decane	LEL % - <0.5	LEL % - <0.5	LEL % - <0.5	LEL % - <0.5	LEL % - <0.5	LEL % - <0.5		
26	Alkyl Benzene	LEL % - 1.5	LEL % - <0.5	LEL % - <0.5	LEL % - <0.5	LEL % - <0.5	LEL % - <0.5		
34	Diisopropyl Benzene	LEL % - 1.0	LEL % - <0.5	LEL % - <0.5	LEL % - <0.5	LEL % - <0.5	LEL % - <0.5		
35	2 Ethylhexyl Acetate	LEL % - <0.5	LEL % - <0.5	LEL % - <0.5	LEL % - <0.5	LEL % - <0.5	LEL % - <0.5		

The Dow Chemical Company, Freeport, Texas

- *"Conventional adsorbents actually increase the rate of evaporation by significantly increasing the surface area of the liquid exposed to the atmosphere. As a result, concentrations in air go up dramatically, thereby increasing threat of fire, exposures, and downwind impact (including odors).*

- *The increased evaporation rate also significantly reduces the time before a reportable quantity is released to the atmosphere.*

- *Because Imbiber Beads actually absorb up to 27 times their volume of spilled material, evaporation and its effects are significantly reduced. We have recently used the material on two styrene spills where the measured concentration of styrene in air was reduced as much as 97% immediately after the Imbiber Blankets were placed on the spill.*

- *Another advantage of the technology is that it will also absorb non-oils including chlorinated solvents. Also, the material is almost 100% hydrophobic, meaning that no water is picked up.*

- *Our studies have shown that a given sized Imbiber Blanket will pick up as much as 25 conventional pads of the same size. On a "per pad" basis, Imbiber Blankets are several times more expensive than conventional pads. However, on a cost per volume of material absorbed, they become much more cost competitive.*

- *If you factor in the disposal cost savings due to reduced volume of waste, they actually come out fairly even. They do make very little ash and have a high BTU value, which makes them suitable for incineration. They should not be used on oxidizers and in potentially reactive chemical combinations should be evaluated".*

Appendix B

A very short history on sorbents:

- Prior to the mid-1960s the primary means of dealing with a baby's continence issues was to use cotton cloth diapers. Cloth diapers were messy, did not keep a baby's bottom dry and as a result rashes and infections had to be closely guarded against. (About the only good thing that could be said of cloth diapers was that they were better than nothing).
- **Super-Absorbent Polymers** – In 1966 **Proctor & Gamble** revolutionized the personal hygiene industry by introducing the world's first disposable diaper (Brand name - Pampers®) featuring the world's first **water-sensitive, super-absorbent polymer**. The SAPs were engineered to completely absorb moisture into their solid, molecular structure and as a result the liquid phase was eliminated; the baby's bottom was kept dry, and as a result less prone to rashes and infections.
- Initially disposable baby diapers encountered resistance due the increased cost of the diapers in comparison to traditional cloth diapers but convenience and superior performance outweighed the cost issue and the disposable baby diaper industry has flourished ever since.
- **Polypropylene** – Also in the mid-1960s **Exxon** developed a methodology for creating a uniform, consistent web of polypropylene fibers that was to be used by the US Navy primarily for air filtration applications.
- Working in cooperation with **3M**, Exxon realised that their new fiber product could also be used as a lightweight adsorbent for cleaning up oil and chemical spills. At the time the products used primarily for this purpose included clay granules, cellulosic materials such as sawdust, wood chips, dried peat moss, and feathers, among others.
- Melt-blown polypropylene (mb-pp) offered some distinct advantages over "traditional" adsorbent products but it was also more expensive than those types of products, and encountered resistance from industry-at-large and really did not get its "boost" into the mainstream sorbent market until the Exxon Valdez incident in 1989, when Exxon ordered container load after container load of it; significantly raising the profile of mb-pp and dramatically impacting upon the revenue of the limited number of suppliers available at the time. Since that time there has been a proliferation of mb-pp producers and suppliers.
- **Imbiber Beads®** - Similarly, in 1968 **The Dow Chemical Company** invented an **oil-sensitive**, super-absorbent polymer that later became known by the brand name **Imbiber Beads®**. Like its water-sensitive counterpart, Imbiber Beads® eliminated the liquid phase when oils, fuels and solvents (organics) were involved and as they were unaffected by water Imbiber Beads® would selectively filter organics from water, and retain the liquid within their solid molecular structure; thereby eliminating secondary contamination of response personnel and the local environment.
- Imbiber Beads® value-added products such as "blankets and booms" offer "distinct advantages" and superior performance over melt-blown polypropylene, including significant reduction in the "rate" at which hazardous vapors are released.

(Like the history behind cloth diapers, about the only good thing about using polypropylene pads and booms on oil spills is that they are better than nothing).