Flow rate timeline

April 24	BP initially asserted that the flow rate from the Macondo well was 1,000 bpd.
April 27	BP internal document showed an estimated flow rate in the range of 1,063-14,266 bpd
April 28	Coast Guard and NOAA publically estimate the flow rate to be at least 5000 bpd, which BP initially disagreed with.
May 4	BP, in a briefing to the House Energy and Environment Subcommittee Members, say that the worst-case flow rate could be 60,000 bpd.
May 24	BP provided internal documents to Markey confirming the 60,000 bpd estimate.
May 27	The Federal Flow Rate Technical Group released its first preliminary estimate of flow rate with a low-end of 12,000-19,000 bpd
June 10	The Federal Flow Rate Technical Group revised its flow rate estimate upwards to 20,000 - 40,000 bpd.
June 15	The Federal Flow Rate Technical Group and DOE scientists revise the flow rate estimate upwards to 35,000 - 60,000 bpd.
July 6, 11	BP internal dispersant documents indicate that dispersant application decisions were made using a flow rate assumption of 53,000 bpd.
August 2	The Federal Flow Rate Technical Group and DOE scientists revise their flow rate estimate upwards to 53,000 bpd (with 10% error) for mid-July and 62,000 bpd at the beginning of the spill.

Bloomberg Businessweek Tuesday September 28, 2010

Available on the iPad

BP Says 1,000 Barrels of Oil Leaking Daily From Gulf Well

April 25, 2010, 6:13 AM EDT

By Peter J. Brennan and Jim Polson

April 25 (Bloomberg) -- BP Plc and the U.S. Coast Guard said about 1,000 barrels of oil is leaking daily in the Gulf of Mexico, after a Transocean Ltd. drilling rig caught fire and sank last week.

"It's 1,000 barrels emanating from 5,000 feet (1,500 meters) below the surface," Coast Guard Rear Admiral Mary Landry, who is overseeing the rescue and cleanup efforts, said at a press conference yesterday. "Absolutely, this is a very serious oil spill."

The Coast Guard April 23 estimated that the rig was leaking about 200 barrels and the well had been tapped. Landry said the well wasn't fully capped and she learned April 24 that oil began surfacing two days earlier.

The spill covers a 400-square-mile section of the Gulf in the shape of a rainbow, about 40 miles (65 kilometers) from the coast, Landry said. It's unknown when the well can be capped, she said.

The rig exploded on April 20, leading to a fire that caused it to sink two days later. Eleven of the 126 workers on board are missing and it's presumed they were in the area of the explosion, Landry said. A search for them has been suspended and their families have been notified, she said.

BP, the oil producer that leased the Deepwater Horizon rig from Transocean, said it was found intact about 5,000-feet deep in the water and about 1,300 feet northwest of the well, according to Doug Suttles, chief operating officer of exploration and production for the oil company.

Blowout

Nearby pipelines that were temporarily shut weren't affected by the rig's explosion and should soon be operating, Landry said.

The rig burned for more than 24 hours after the explosion that Geneva-based Transocean said may have been caused by a so- called blowout, an unexpected surge in pressure that ejected petroleum at the top of the well.

If the missing workers died, it would be the deadliest U.S. offshore rig explosion since 1968, when 11 died and 20 were injured at a platform owned by Gulf Oil Corp., according to data from the Minerals Management Service. A 1987 helicopter crash aboard a Forest Oil Corp. platform killed 14 people.

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Using "Standard Guide for Visually Estimating Oil Spill Thickness on Water, ASTM F 2534 - 06."

ATTACHMENT 1

Oil on Water Estimate - Low

	sq mi	Cover Factor	gal/sq mi	gals	bbls
Sheen	1500	0.5	50	37500	893
Dull oil	250	0.2	666	33300	793
Dark oil	9	0.15	3330	4495.5	107
Total oil on water				75296	1793
x 2 to compensate for evap and disp					3586
recovered					200
chemically dispersed					1000
Total emitted					4786
Barrels emitted per day					**1063**

Oil on Water Estimate - Best Guess

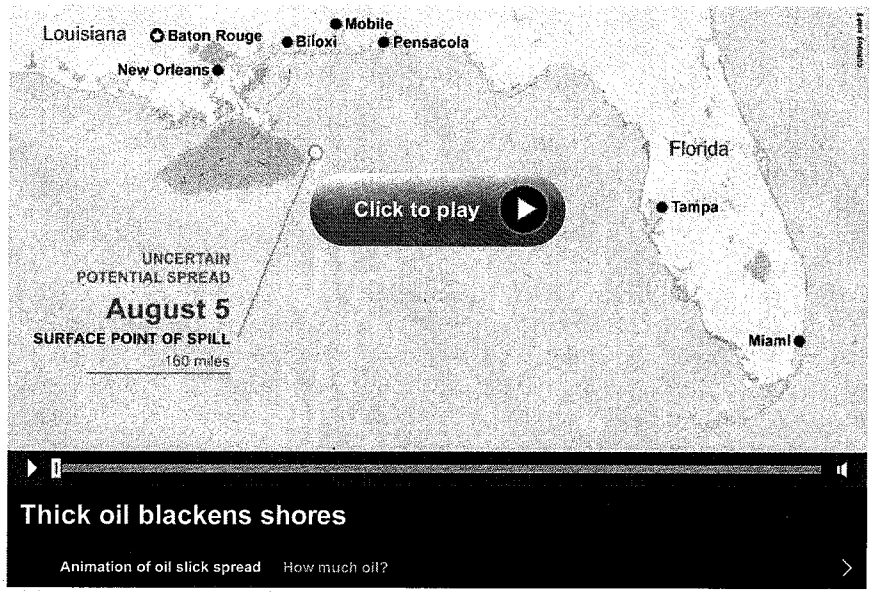
	sq mi	Cover Factor	gal/sq mi	gals	bbls
Sheen	1500	0.66	333	329670	7849
Dull oil	250	0.35	1332	116550	2775
Dark oil	9	0.25	6660	14985	357
Total oil on water				461205	10981
x 2 to compensate for evap and disp					21962
recovered					450
chemically dispersed					3500
Total emitted					25912
Barrels emitted per day					**5758**

Oil on Water Estimate - High

	sq mi	Cover Factor	gal/sq mi	gals	bbls
Sheen	1500	0.75	666	749250	17839
Dull oil	250	0.5	3330	416250	9911
Dark oil	9	0.35	13320	41958	999
Total oil on water				1E+06	28749
x 2 to compensate for evap and disp					57498
recovered					700
chemically dispersed					6000
Total emitted					64198
Barrels emitted per day					**14266**

Oil spill from rig explosion at 5,000 barrels a day

By the CNN Wire Staff
April 29, 2010 -- Updated 0313 GMT (1113 HKT)



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STORY HIGHLIGHTS

- BP head says Transocean's "blowout preventer" failed to operate before explosion
- Controlled burn begins on spilled oil, Coast Guard says
- Oil spill has potential to become one of worst in U.S. history, Coast Guard official says
- Oil slick is more than 20 miles from Louisiana coastline

(CNN) -- The estimated amount of oil spilling in an underwater leak from last week's oil rig explosion in the Gulf of Mexico has increased to 5,000 barrels a day, five times more than what was originally believed, a Coast Guard official said late Wednesday.

Rear Adm. Mary Landry said the increased estimate is based on analysis from the federal National Oceanic and Atmospheric Administration. She noted that there are "a lot of variables" in calculating the rate of the spill.

Additionally, a third underwater oil leak has been located in the pipeline that connected the rig to the oil well, said Doug Suttles, chief operating officer for BP, who joined Landry at a news conference. Two other leaks were located within 36 hours of the April 20 explosion.

The head of BP Group told CNN's Brian Todd in an exclusive interview Wednesday that the accident could have been prevented, and he focused blame on rig owner Transocean Ltd.

CEO Tony Hayward said Transocean's "blowout preventer" failed to operate before the explosion. A blowout preventer is a large valve at the top of a well, and activating it will stop the flow of oil. The valve may be closed during drilling if underground pressure drives up oil or natural gas, threatening the rig.

"That is the ultimate fail-safe mechanism," Hayward said. "And for whatever reason -- and we don't understand that yet, but we clearly will as a consequence of both our investigation and federal investigations -- it failed to operate.

"And that is the key issue here, the failure of the Transocean [blowout preventer]," Hayward said, describing the valve as "an integral part of the drilling rig," which is operated by Transocean.

Video: Oil spill from the air

Video: Effort to secure oil rig under way

Video: BP official on oil spill burn

A Transocean spokesman on Wednesday declined to respond to Hayward's comments, citing pending litigation against both companies. However, Transocean Vice President Adrian Rose has said its oil rig had no indication of problems before the explosion.

Asked whether the accident could have been prevented, Hayward said, "All accidents can be prevented -- there's not doubt about that."

BP owns the oil well. Before the explosion, Hayward had announced a significant discovery of at least 50 million barrels of oil. "Of course, all of that is completely irrelevant in the context of what we're now dealing with."

Connect the World blog: Should there be a full ban on off-shore drilling?

What crews are dealing with is an oil spill from the explosion that continues to grow in the Gulf of Mexico. A controlled attempt to burn off part of the spill started Wednesday evening, the U.S. Coast Guard said.

RELATED TOPICS

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U.S. Coast Guard

Landry said the successful burn was completed later Wednesday night.

The burn-off is part of the effort to prevent the spread of oil from an underwater well that was broken open when the drill rig Deepwater Horizon blew up and sank last week. The slick stretched about 100 miles across the north-central Gulf on Wednesday afternoon and had advanced to within 16 miles of the mouth of the Mississippi River, the U.S. Coast Guard said.

Efforts to cap the well have so far been unsuccessful, Landry said Wednesday. The cause of the explosion remains under investigation, and search efforts have been halted for the 11 workers missing after the blast.

At least one of the victims' families has filed a lawsuit against BP and Transocean, accusing BP specifically of negligence.

"The responsibility for safety on the drilling rig is with Transocean," Hayward said. "It is their rig, their equipment, their people, their systems, their safety processes."

He said that, despite reports to the contrary, BP has not resisted attempts at tightening safety regulations. "We welcome tighter safety regulations. But we'd like them to be applied in a way that makes them practically impermeable."

BP and the Coast Guard planned to corral part of the oil slick using a 500-foot, specially designed boom, and then set it ablaze. The flames are expected to destroy between 50 to 90 percent of the oil in that section, and winds should blow the resulting cloud of smoke and soot out to sea, said Lt. Cmdr. Matt Moorlag, a Coast Guard spokesman.

"It's a historically proven technique, and it has multiple preventative safety measures in place to ensure that that burn area remains controlled," Moorlag said.

The oil spill has the potential to become one of the worst in U.S. history, Landry said Tuesday. The well, about 50 miles off the mouth of the Mississippi River, is dumping about 42,000 gallons a day into the Gulf of Mexico. BP, the well's owner, has been dropping

dispersant chemicals on the slick and trying to shut off the flow using remote-controlled submarines, but has had no luck.

The spill stretched eastward from a point about 16 miles south of the mouth of the Mississippi River to about 94 miles south of Pensacola, Florida. It was about 30 miles wide at some points. Louisiana Gov. Bobby Jindal said the slick was expected to hit the southeastern Louisiana shoreline late Friday or before dawn Saturday.

Jindal said the state has asked for 55,000 feet of booms to keep oil away from the marshy, environmentally delicate coast, which is rich in shellfish and wildlife.

"We want to approach this situation the same way we would approach a hurricane or other natural disaster," he said. "We think it's best to hope for the best, but prepare for the worst."

The slick left many who draw their living from the water and coastal wetlands "watching and praying," said Tony Fernandez, owner of the Breton Sound Marina near Hopedale, Louisiana.

"For the most part, what we're doing is mostly waiting," Fernandez said. "There's not much that laypeople can do with this." People in the area are closely watching the Coast Guard plans to burn off portions of the slick, he said.

"I guess it's a question of water pollution or air pollution," he said.

Most of the slick is a thin sheen on the water's surface. About 3 percent of it is a heavy, pudding-like crude oil. At its current flow, the spill would take more than 260 days to rival the 1989 Exxon Valdez disaster, when about 11 million gallons spilled into Alaska's Prince William Sound.

But even if the Gulf spill never compares in size to the Exxon Valdez, it could have serious ecological repercussions if it makes landfall.

Efforts are already under way near the shoreline to deal with that potential scenario, including positioning boom material around sensitive ecological areas. Five staging areas have been set up on land, stretching from Venice, Louisiana, to Pensacola, Florida.

"If it reaches the shoreline, ourselves and the Coast Guard ... will deal with it," Hayward said. "And we will clean it up, if we get to that position."

He said BP's operation to attack the swath of oil, which is now the size of Delaware, is costing the company $6 million a day.

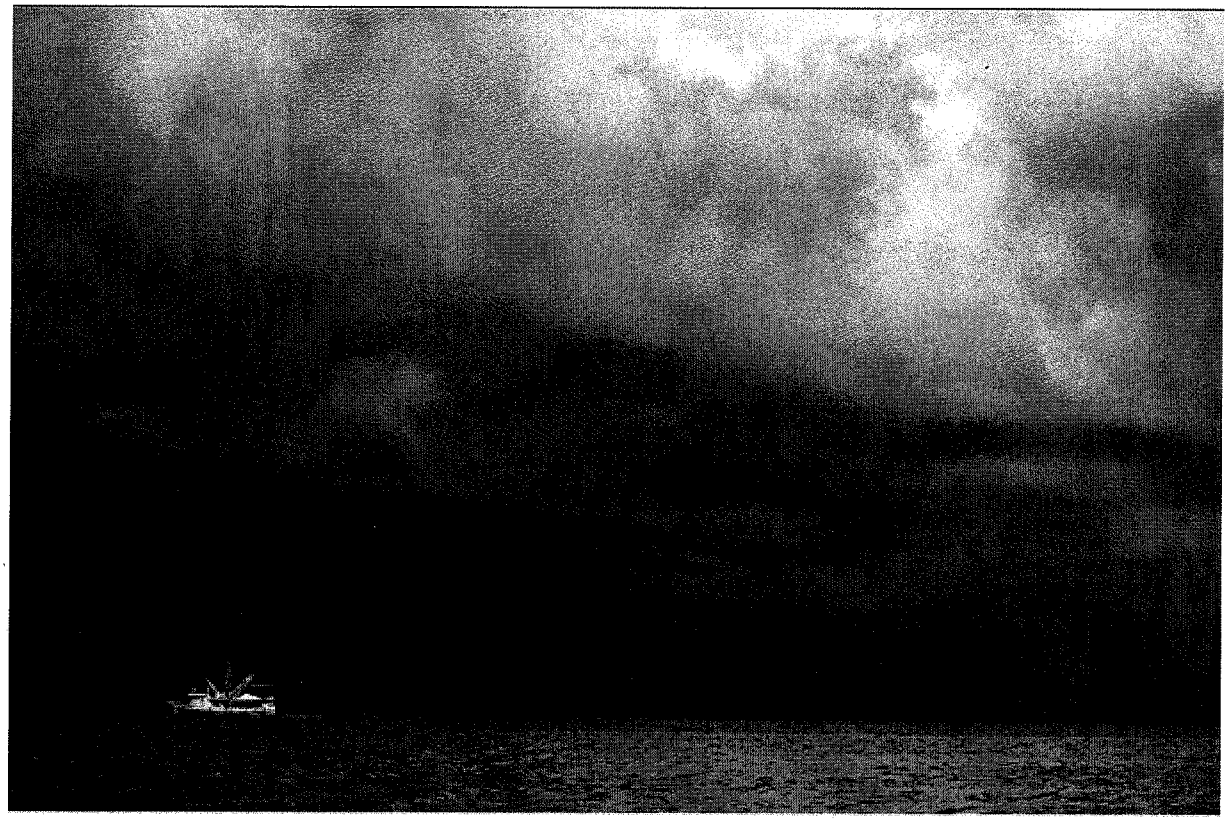
The remote-controlled submarines are being used by BP in an attempt to activate the well's blowout preventer to choke the flow of oil.

BP also is bringing in another drilling rig that could seal the well, but that effort would take months, according to a BP spokesman.

In the meantime, the company is working on a novel approach to capture the oil -- placing a dome right above the well head. The dome will resemble an inverted funnel, with a pipe leading up to ships waiting at the surface that would take away the oil. That tactic has never been tried in deep water, and a BP spokesman said the dome won't be ready for two to four weeks.

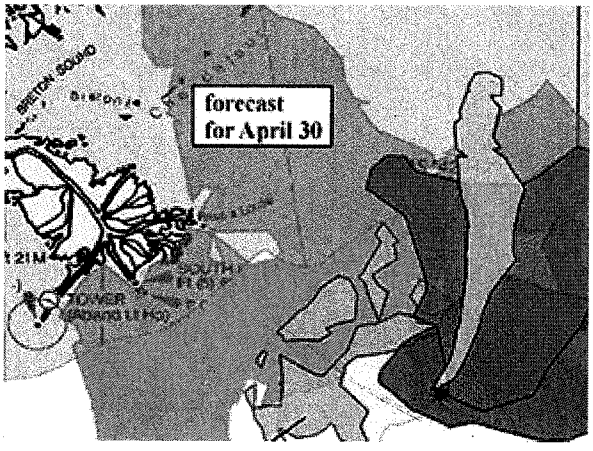
Gulf Oil Spill Could Eclipse Exxon Valdez Disaster

by NPR STAFF AND WIRES



1 of 36

A boat uses a boom and absorbent material to soak up oil in Cat Bay, near Grand Isle, La., on June 28. A tropical storm is expected to hit the Gulf and impede cleanup efforts. (Joe Raedle/Getty Images)



NOAA

The tan color indicates the trajectory of the oil spill for April 30.

April 29, 2010

text size A A A

An oil spill that threatened to eclipse even the Exxon Valdez disaster spread out of control and drifted inexorably toward the Gulf Coast as fishermen rushed to scoop up shrimp and crews spread floating barriers around marshes.

The spill was both bigger and closer than imagined — five times larger than first estimated, with the leading edge just 3 miles from the Louisiana shore.

"It is of grave concern," David Kennedy of the National Oceanic and Atmospheric Administration, told The Associated Press.

"I am frightened. This is a very, very big thing. And the efforts that are going to be required to do anything about it, especially if it continues on, are just mind-boggling."

The oil slick could become the nation's worst environmental disaster in decades, threatening hundreds of species of fish, birds and other wildlife along the Gulf Coast, one of the world's richest seafood grounds, teeming with shrimp, oysters and other marine life.

Louisiana Gov. Bobby Jindal declared a state of emergency Thursday, and President Obama pledged his administration will use "every single resource at our disposal."

Jindal made the declaration shortly after Homeland Security Secretary Janet Napolitano called the disaster a "spill of national significance."

The Coast Guard worked with BP, which operated the oil rig that exploded and sank last week, to deploy floating booms, skimmers and chemical dispersants, and set controlled fires to burn the oil off the water's surface. Obama said the response could include the Defense Department.

Thursday's order allows the state to free up resources to begin preparing for the oil to reach the shore.

Napolitano, Interior Secretary Ken Salazar and environmental protection administrator Lisa Jackson will travel Friday to the Gulf of Mexico to oversee efforts to contain the spill. White House press secretary Robert Gibbs said the administration also may send military ships and personnel to help control damage from the spill.

British oil giant BP confirmed Thursday that up to 5,000 barrels, or 200,000 gallons, of oil a day are spilling from the site of the deadly oil rig explosion.

At that rate, the spill could easily eclipse the worst oil spill in U.S. history — the 11 million gallons that leaked from the grounded tanker Exxon Valdez in Alaska's Prince William Sound in 1989 — in the three months it could take to drill a relief well and plug the gushing well 5,000 feet underwater on the seafloor. Ultimately, the spill could grow much larger than the Valdez because Gulf of Mexico wells typically hold many times more oil than a single tanker.

Jackie Savitz, a toxicology scientist with the environmental group Oceani, says that at the current flow rate, the spill will reach the 11 million gallon mark of the Exxon Valdez spill in 50 days. The Gulf holds several endangered and threatened species, including four species of endangered sea turtle, in addition to dolphins, porpoises and whales.

"This is one of only two spawning areas for bluefin tuna in the world," Savitz said. "If larvae are exposed, there's a good chance they won't survive or their survival will be reduced because of the oil spill."

Doug Suttles, the oil company's chief operating officer, told NBC's *Today* show that oil is bubbling up from the ocean bottom at a rate of 1,000 to 5,000 barrels a day. He said the company would welcome help from the U.S. Defense Department and other agencies in containing the slick.

"We'll take help from anyone," Suttles said.

As the slick has grown, so have potential cleanup costs.

"As the president and the law have made clear, BP is the responsible party" for costs, Napolitano said.

A third leak was discovered in the blown-out well, which is about a mile under water. Coast Guard Rear Adm. Mary Landry said it may be time for government agencies to offer up "technologies that may surpass abilities of the private sector" to get the slick under control.

Landry said more than 5,000 barrels a day of sweet crude are discharging into the gulf, not the 1,000 barrels officials had estimated for days since the Deepwater Horizon drilling rig exploded and sank 50 miles off the Louisiana Coast. The new oil spill estimate came from the federal National Oceanic Atmospheric Administration.

Initially, Suttles said he did not believe the amount of oil spilling into the water was greater than earlier estimates. But on Thursday, he acknowledged that the leak may be as high as the government is estimating.

"Using the satellite imagery and our overflights, we can now say it looks like it's more than a thousand. It's a range" of up to 5,000, he said.

BP spokesman John Curry said it doesn't really matter what the numbers are, the slick is what it is, and corralling it is the important thing.

"We can't physically go down and put a meter on the leak to measure how much is flowing, so it's all a guess, it's all an estimate," he said. "And the different estimates don't change our response. I mean, they all are within the general range of uncertainty, and we're not going to stop until we get this done."

Eleven workers are missing and presumed dead, and more than 100 escaped the blast, the cause of which has not been determined.

Industry officials say replacing the Deepwater Horizon, owned by Transocean Ltd. and operated by BP, would cost up to $700 million. BP has said its costs for containing the spill are running at $6 million a day. The company said it will spend $100 million to drill the relief well. The Coast Guard has not yet reported its expenses.

Material from NPR's Wade Goodwyn and The Associated Press was used in this report.

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Recent First

Ted S (I_Go_To_Pieces) wrote:

dallasnews.com
The Dallas Morning News

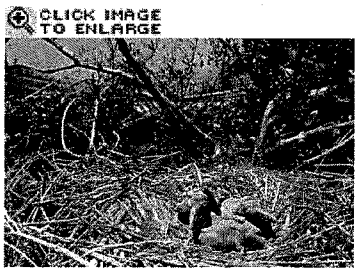
60,000 barrels a day worst-case scenario for gulf spill, BP tells Congress

08:15 AM CDT on Wednesday, May 5, 2010

FROM WIRE REPORTS The New York Times, The Associated Press

Calm waters in the Gulf of Mexico on Tuesday allowed crews to step up efforts to contain the crude oil leaking uncontrollably into the sea and spreading toward the coasts of four states.

Meanwhile, BP, the company responsible for fighting the spill, told members of Congress in Washington in a closed-door briefing that the leaking oil well five miles beneath the surface of the gulf could, in a worst-case scenario, spill as many as 60,000 barrels of oil a day, more than 10 times the estimate of the current flow.



DAVE MARTIN/The Associated Press
Oil containment booms lie tangled in the growth near the nests of young brown pelicans on New Harbor Island off the Louisiana coast. Some booms were damaged in rough weekend weather.

For now, weather patterns seem to be holding the giant oil slick offshore, and are expected to do so for several more days, temporarily sparing the coast. A containment dome is being readied to drop over the worst of the leaks by Thursday, BP officials said.

Cleanup crews Tuesday were able to put out more containment equipment and repair some booms damaged in rough weather over the weekend. They also hoped to again try to burn some of the oil on the water's surface, possibly today.

The scope of the problem has grown drastically since BP's Deepwater Horizon oil drilling platform exploded and capsized into the gulf last month, killing 11 workers.

Amid growing uncertainty about the extent of the leak and when it might be stanched, BP faced intensified pressure on multiple fronts Tuesday, from increasingly frustrated residents of the Gulf Coast to federal, state and local officials demanding more from the company.

BP has dispatched executives to hold town meetings in the affected region, and it has turned to lower-profile social media outlets to trumpet its cleanup efforts and moves to organize volunteers.

The Senate energy committee has summoned executives from BP and Transocean, the company contracted by BP to drill the well, as well as a number of oil industry technical experts, to a hearing next week. The next day, the oversight and investigations subcommittee of the House Energy and Commerce Committee will hold a hearing, at which top executives of BP, Transocean and Halliburton have been asked to appear, a committee spokeswoman said.

A separate federal investigation into the explosion is under way by the Coast Guard and the Minerals Management Service.

At Tuesday's briefing, David Rainey, the BP vice president for Gulf of Mexico production, and officials from Transocean and from Halliburton, which was providing cementing services on the platform, also acknowledged that they did not know how likely it was that oil from the spill would be caught up in the so-called loop currents in the gulf and be carried through the Florida Keys into the Atlantic Ocean.

"What we heard today from BP, Halliburton and Transocean were a lot of worst-case scenarios without any best-case solutions," said Rep. Edward Markey, D-Mass., who leads the Energy and Environment Subcommittee of the House energy panel.

Federal officials have raised the possibility of a leak of more than 100,000 barrels a day if the well were to flow unchecked, but the chances of that situation occurring were unclear.

Also Tuesday, BP's chief executive, Tony Hayward, told Sen. Bill Nelson, D-Fla., that the spill clearly would cause more than $75 million in economic damage, the current cap on liability for drilling accidents.

Nelson and the two Democratic senators from New Jersey have introduced legislation to raise that cap to $1 billion or more.

Hayward said the cap is largely irrelevant. "It's got nothing to do with caps," he said. "All legitimate claims ... will be honored."

While a rainbow sheen of oil has reached land in Louisiana, the gooey rafts of coagulated crude have yet to come ashore in most places.

"The waiting is the hardest part. The not knowing," said Dodie Vegas, 44, who runs the Bridge Side Cabins complex in Grand Isle, a resort and recreational fishing community that's just about as far south in Louisiana as you can go. So far, two fishing rodeos have been canceled, and 10 guests have canceled their rooms.

"You got people canceling out, thinking we've got oil on the beaches, and it's not even at the mouth of the Mississippi," said Frank Besson, 61, owner of Nez Couple Souvenir & Tackle.

The Environmental Protection Agency stepped up air quality monitoring on the Gulf Coast after people in New Orleans and elsewhere reported a strong odor of petroleum. Some in a throng standing on the beach Saturday in Gulfport, Miss., were convinced they could smell the slick – until someone pointed out a diesel truck idling 50 feet away. When the truck left, so did the smell.

Fishermen have complained bitterly about the federal decision to close a large swath of the gulf to commercial and sport fishing, saying it was an overreaction.

But U.S. Sen. David Vitter, R-La., said it was necessary to reassure the American public that the seafood on restaurant menus and store shelves is safe.

In Gulf Shores, Ala., real estate firm Brett/Robinson Vacations sent a note to those renting vacation properties that they would not be penalized for any spill-related cancellations but urged them not to jump the gun.

There are legitimate concerns, experts say. A second bird found in the slick, a brown pelican, is recovering at a bird rescue center in Louisiana. National Wildlife Federation president and CEO Larry Schweiger says there's no way to know how many birds have been oiled because the slick is so big and so far offshore.

The New York Times,

The Associated Press

ATTACHMENT 6

Seafloor Exit
7" x 9-7/8" Casing Annulus Flow Path

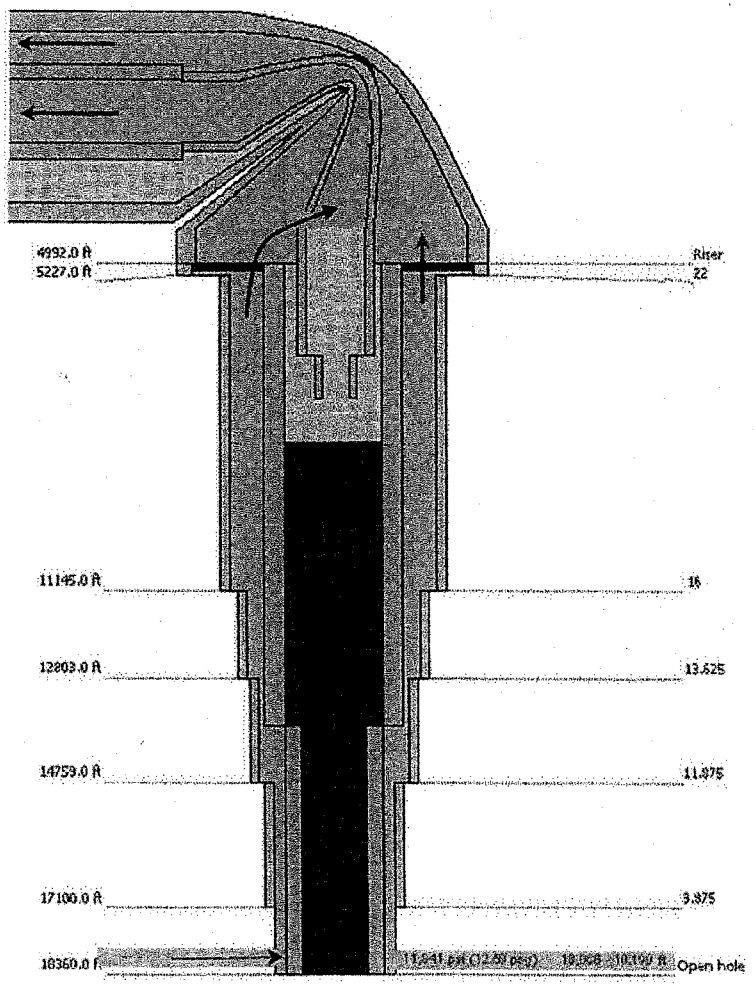
Worst case theoretical flow assumes:

- Split 5-1/2" drill pipe at subsea BOP and flow out 6-5/8" drill pipe
- Maximum theoretical flow rate is 60,000 BOPD

Items that reduce worst case theoretical flow:

- Crushed and bent riser and drill pipe
- Cement sheath in open hole by casing annulus
- Casing hanger and pack-off restriction
- Sand production (unconsolidated formation)
- Shale collapse
- Water production
- BOP functions activated
- Expected range of possible flow rates is 5,000 to 40,000 BOPD

NOTE: Removal of all restrictions (riser, BOP, and drill pipe) adds ~10,000 BOPD to rates above



ATTACHMENT 7

Key Messages

Expected Case:

In the current state a wellhead pressure decrease from 3800 psi to 2270 psi (pressure seafloor) results in a flow rate increase ranging from 15% to 30%

Alternate Case:

If fluid flow is only through the drill pipe – and then the drill pipe is unintentionally removed and flows into the sea (2270 psi):

- For flow up the annulus the rate doubles
- For flow inside production casing the rate triples

Note:

If BOP and wellhead are removed and if we have incorrectly modeled the restrictions – the rate could be as high as ~ 100,000 barrels per day up the casing or 55,000 barrels per day up the annulus (low probability worst cases)

U.S. PANEL SAYS LEAK MAY HAVE BEEN 12,000-19,000 BARRELS/DAY

(The following is a reformatted version of a press release issued by the U.S. Interior Department and received via electronic mail. The release was confirmed by the sender.)

Date: May 27, 2010

Flow Rate Group Provides Preliminary Best Estimate Of Oil Flowing from BP Oil Well

USGS Director Dr. Marcia McNutt today announced that the National Incident Command's Flow Rate Technical Group (FRTG) has developed an independent, preliminary estimate of the amount of oil flowing from BP's leaking oil well.

In making the announcement, Dr. McNutt, who is the chair of the FRTG, established by Admiral Thad Allen, the National Incident Commander, emphasized that since day one, the Administration's deployments of resources and tactics in response to the BP oil spill have been based on a worst-case, catastrophic scenario, and have not been contained by flow rate estimates.

Based on three separate methodologies, outlined below, the independent analysis of the Flow Rate Technical Group has determined that the overall best initial estimate for the lower and upper boundaries of flow rates of oil is in the range of 12,000 and 19,000 barrels per day.

The FRTG used three separate methodologies to calculate their initial estimate, which they deemed the most scientifically- sound approach, because measurement of the flow of oil is extremely challenging, given the environment, unique nature of the flow, limited visibility, and lack of human access to BP's leaking oil well.

Mass Balance Team

The first approach led by the Mass Balance Team analyzed how much oil is on the surface of the Gulf of Mexico. The Mass Balance team developed a range of values using USGS and NOAA analysis of data that was collected from NASA's Airborne Visible InfraRed Imaging Spectrometer (AVIRIS), an advanced imaging tool. USGS has previously used the AVIRIS tool to discover water on the moon. This is the first time it has been used to measure the volume of an oil spill.

Based on observations on May 17th, and accounting for thin oil not sensed by the AVIRIS sensor, the FRTG estimated that between 130,000 and 270,000 barrels of oil are on the surface of the Gulf of Mexico. It is important to note that the FRTG also estimated that a similar volume of oil to the amount AVIRIS found on the surface has already been burned, skimmed or dispersed by responders or has evaporated naturally as of May 17th.

Given the amount of oil observed and the adjusted calculations for the amount of oil that has been burned, skimmed, dispersed, or evaporated the initial estimate from the Mass Balance Team is in the range of 12,000 to 19,000 barrels of oil per day.

This methodology carried several challenges, including the fact that the AVIRIS plane can only fly over a portion of the spill in a day, meaning that an assumption must be made that the area imaged is representative of the entire spill region.

Plume Modeling Team

The second approach led by the Plume Modeling Team used video observations of the oil/gas mixture escaping from the kinks in the riser and at the end of the riser pipe alongside advanced image analysis to estimate fluid velocity and flow volume. Based on advanced image analysis and video observations the Plume Modeling Team has provided an initial range estimate of 12,000 to 25,000 barrels of oil per day.

This team faced several methodological challenges, including having a limited window of data in time to choose from, getting good lighting and unobstructed views of the end of the riser, and estimating how much of that flow is oil, gas, hydrates, and water.

Riser Insertion Tube Tool Estimate

Both estimates from the Mass Balance Team and the Plume Modeling Team were reality-checked with a basic calculation of the lower limit of possible oil that is spilling. The lower limit was calculated based on the amount of oil collected by the Riser Insertion Tube Tool (RITT), plus the estimate of how much oil is escaping the RITT, and how much oil is leaking from the kink in the riser.

On May 25, 2010, at approximately 17:30 CDT, the RITT logged oil collection at a rate of 8,000 barrels of oil per day, as measured by a meter whose calibration was verified by a third- party. Based on observations of the riser, the team estimated that at least 10% of the flow was not being captured by the riser at the time oil collection was logged, increasing the estimate of total flow to 8,800 barrels of oil per day. Factoring in the flow from the kink in the riser, the RITTI Team calculated that the lower bound estimate of the total oil flow is at least 11,000 barrels of oil per day, depending on whether the flow through the kink is primarily gas or oil. The lower bound estimate calculated by the RITT Team is more than twice the amount of the earlier flux estimate of 5,000 barrels of oil per day and is independent of any calculations or model assumptions made by either team above.

On-going Calculations

The preliminary estimates provided by the FRTG are based on new methodologies being employed to understand a highly dynamic and complex situation. As the FRTG collects more data and improves their scientific modeling in the coming days and weeks ahead, they will continue to refine and update their range of oil flow rate estimates, as appropriate.

The FRTG is working diligently to ensure all estimates are peer reviewed by independent experts and academics as expeditiously as possible. They will also establish a website to ensure this information is available and reported to the public in a timely fashion.

Response

Below are the resources surged to date to mitigate the impacts of the spill:

· Approximately 1,300 vessels are responding on site, including skimmers, tugs, barges, and recovery vessels to assist in containment and cleanup efforts--in addition to dozens of aircraft, remotely operated vehicles, and multiple mobile offshore drilling units.

· More than 1.85 million feet of containment boom and 1.25 million feet of sorbent boom have been deployed to contain the spill--and approximately 300,000 feet of containment boom and 1 million feet of sorbent boom are available.

· Approximately 11 million gallons of an oil-water mix have been recovered.

· Approximately 840,000 gallons of total dispersant have been deployed--700,000 on the surface and 140,000 subsea. More than 380,000 gallons are available.

· 17 staging areas are in place and ready to protect sensitive shorelines, including: Dauphin Island, Ala., Orange Beach, Ala., Theodore, Ala., Panama City, Fla., Pensacola, Fla., Port St. Joe, Fla., St. Marks, Fla., Amelia, La., Cocodrie, La., Grand Isle, La., Shell Beach, La., Slidell, La., St. Mary, La.; Venice, La., Biloxi, Miss., Pascagoula, Miss., and Pass Christian, Miss.

Background

The Flow Rate Technical Group is comprised of federal scientists, independent experts, and representatives from universities around the country. It includes representatives from USGS, NOAA, DOE, Coast Guard, MMS, the national labs, National Institute of Standards and Technology, UC Berkeley, University of Washington, University of Texas, Purdue University, and several other academic institutions. BP is not involved in the FRTG except to supply raw data for the scientists and experts to analyze.

FRTG Members from the Federal Government appointed to date include:

Marcia McNutt, Director, USGS; William Rees, Jr., Los Alamos National Lab, Department of Energy; Darren Mollot, Department of Energy; Franklin Shaffer, Department of Energy; Victor Labson, USGS; Bill Lehr, National Oceanic and Atmospheric Administration; Austin Gould, US Coast Guard; Richard Brannon, US Coast Guard; Don Maclay, Minerals Management Service (MMS); Gerald Crawford, MMS; David Absher, MMS; and Bill Courtwright, MMS.

FRTG Members from academia and independent organizations appointed to date include:

Omar Savas, Professor of Mechanical Engineering, University of California Berkeley

James Riley, Professor of Mechanical Engineering, University of Washington

Juan Lasheras, Prof. of Engineering and Applied Sciences, University of California San Diego

Poojitha Yapa, Professor of Civil and Environmental Engineering, Clarkson University

Paul Boomer, Senior Lecturer, Petroleum and Geosystems, University of Texas at Austin

Steve Wereley, Associate Professor of Mechnical Engineering, Purdue University

Peter Cornillon, Professor of Oceanography, University of Rhode Island

Ira Leifer, Assoc. Researcher, Marine Science Institute, University of California Santa Barbara

Alberto Aliseda, Assistant Professor of Mechanical Engineering, University of Washington Pedro Espina, National Institute of Standards and Technology.

For more information, visit www.deepwaterhorizonresponse.gov.

Contact: Julie Rodriguez, 202-208-6416

(kgt)NY

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DATE: June 10, 2010 4:11:07 PM CDT

Admiral Allen; Dr. McNutt Provide Updates on Progress of Scientific Teams Analyzing Flow Rates from BPâ€™s Well

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Deepwater Horizon Incident Joint Information Center

Phone: (985) 902-5231
(985) 902-5240

WASHINGTON -- Under the direction of National Incident Commander Admiral Thad Allen, the Flow Rate Technical Group (FRTG), which is led by United States Geological Survey Director Dr. Marcia McNutt, and a scientific team led by Energy Secretary Steven Chu are analyzing new data and bringing together several scientific methodologies to develop an updated estimate of how much oil is flowing from BP's leaking oil well in the Gulf of Mexico.

The updated estimate, which will bring together the ongoing work of scientists and engineers from the federal government, universities, and research institutions, will be of how much oil has been flowing since the riser was cut on June 3.

"Developing accurate and scientifically grounded oil flow rate information is vital, both in regards to the continued response and recovery, as well as the important role this information may play in the final investigation of the failure of the blowout preventer and the resulting spill," said Admiral Allen, the National Incident Commander. "Top government and independent scientists are working non-stop to analyze all the information available and refine assessments being developed through numerous methodologies. I have directed Dr. McNutt and Secretary Chu to analyze the latest data and assess the various methodologies that are being used and bring them together into an updated best estimate of how much oil is now flowing from BP's well. They will have that updated best estimate in the coming days."

Dr. McNutt announced today that three of the scientific teams analyzing flow rates have reached updated assessments, based on new data or analysis, of flow rates from BP's well before the riser was cut on June 3. The Department of the Interior and the Department of Energy have also directed BP to provide precise differential pressure measurements inside and outside the top hat to allow federal scientists to develop another independent estimate of how much oil is flowing from BP's well.

"Each of the methodologies that the scientific teams is using has its advantages and shortcomings, which is why it is so important that we take several scientific approaches to solving this problem, that the teams continue working to refine their analyses and assessments, and that those many data points inform the updated best estimate that we are developing, " said Dr. McNutt.

Below is a summary of the independent scientific methodologies that are being used to develop assessments of flow rates.

1. Analysis of Pressure Readings (DOE scientists led by Secretary Chu)

A team of federal scientists led by Energy Secretary Steven Chu is analyzing pressure readings from the BOP stack and the riser to assess flow rates and how flow rates may have changed as a result of the riser being cut.

The Department of the Interior and the Department of Energy have directed BP to provide precise differential pressure measurements inside and outside the top hat to allow federal scientists to develop another independent estimate of how much oil is flowing from BP's well.

2. Flow Rate Technical Group

The Flow Rate Technical Group (FRTG), which was convened by Admiral Allen and which is led by USGS Director Dr. Marcia McNutt, is comprised of several Sub-Teams that are pursuing independent approaches to estimating the oil flow rate from the damaged well. The FRTG will soon have an assessment of how much oil has been flowing from BP's well since the riser was cut on June 3.

- **The Plume Modeling Team of the FRTG** is pursuing the approach of observing video of the oil/gas mixture escaping from the damaged well, using particle image velocimetry analysis to estimate fluid velocity and flow volume. On May 27, the Plume Modeling Team, which analyzed video obtained from BP, provided an initial lower bound estimate of 12,000 to 25,000 barrels of oil per day, but at that point were continuing their work to provide an upper bound estimate.

Based on additional video that BP was directed to provide, members of the Plume Modeling Team have now calculated updated lower and upper bound range estimates for a period of time before the Riser Insertion Tube Tool was inserted and before the riser was cut. Most of the experts have concluded that, given the limited data available and the small amount of time to process that data, the best estimate for the average flow rate for the leakage prior to the insertion of the RITT is between 25,000 to 30,000 barrels per day, but could be as low as 20,000 barrels per day or as high as 40,000 barrels per day.

- **The Mass Balance Team of the FRTG** is using remote sensing data from deployment of the Airborne Visible InfraRed Imaging Spectrometer (AVIRIS) and satellite imagery to calculate the amount of oil on the ocean surface on a certain day. The team is correcting the value for oil evaporated, skimmed, burned, and dispersed up to that day and divided by time to produce an average rate.

Based on observations on May 17th, and given the amount of oil observed and the adjusted calculations for the amount of oil that has been burned, skimmed, dispersed, or evaporated the initial estimate from the Mass Balance Team that was announced on May 27 was in the range of 12,000 to 19,000 barrels of oil per day. The team continued to refine its estimate and has concluded that the best estimate for the average flow rate was in the range of 12,600 to 21,500 barrels of oil per day.

- **The Reservoir Modeling Team of the FRTG** will describe the geologic formations as well as composition and pressures of the oil, natural gas, and other compounds that are being released. Using open-hole logs; pressure, volume, and temperature data; core samples; and analog well or reservoir data; the team will populate computer models and determine flow rate from targeted sands in the well as a function of bottomhole pressure. The reservoir modeling team is continuing to work on independent estimates that will be completed later this month
- **The Nodal Analysis Team of the FRTG** will use input from reservoir modeling (including pressure, temperature, fluid composition and properties over time) and pressure and temperature conditions at the leak points on the sea floor, along with details of the geometries of the well, BOP, and riser to calculate fluid compositions, properties, and fluxes from both before and after riser removal. The nodal analysis team is continuing to work on independent estimates that will be completed later this month

3. Woods Hole Analysis

In coordination with the Unified Command, a team of experts lead by Woods Hole Oceanographic Institution (WHOI) and assisted by researchers from Johns Hopkins University, University of Georgia and Massachusetts Institute of Technology used acoustic technologies to measure flow rates after the top-kill attempt ended and before the riser was cut. Using an ROV, flow estimates have been derived from three different view angles above the riser pipe and three different view angles above the BOP. Woods Hole Oceanographic's initial total flow rate estimate of 0.12m3/s to 0.23m3/s from before the riser was cut is a preliminary bulk flow estimate. This outflow may contain gases, liquids, and solids including natural gas, condensates, oil, sediments, and produced water.

To view the Plume Team Estimates, click here.

To view the Plume Team Statement, click here.

To view the Woods Hole Statement, click here.

For a list of FRTG Team membership click here.

For a list of FRTG member bios click here.

For information about the response effort, visit www.deepwaterhorizonresponse.com.

U.S. DEPARTMENT OF ENERGY

June 15, 2010

U.S. Scientific Team Draws on New Data, Multiple Scientific Methodologies to Reach Updated Estimate of Oil Flows from BP's Well

Washington - Based on updated information and scientific assessments, Secretary of Energy Steven Chu, Secretary of the Interior Ken Salazar, and Chair of the National Incident Command's Flow Rate Technical Group (FRTG) Dr. Marcia McNutt (Director of the U.S. Geological Survey) today announced an improved estimate of how much oil is flowing from the leaking BP well.

Secretary Chu, Secretary Salazar, and Dr. McNutt convened a group of federal and independent scientists on Monday to discuss new analyses and data points obtained over the weekend to produce updated flow rate estimates. Working together, U.S. government and independent scientists estimate that the most likely flow rate of oil today is between 35,000 and 60,000 barrels per day. The improved estimate is based on more and better data that is now available and that helps increase the scientific confidence in the accuracy of the estimate.

At the direction of the federal government, BP is implementing multiple strategies to significantly expand the leak containment capabilities at the sea floor even beyond the upper level of today's improved estimate. The Lower Marine Riser Package (LMRP) cap that is currently in place can capture up to 18,000 barrels of oil per day. At the direction of the federal government, BP is deploying today a second containment option, called the Q4000, which could expand total leak containment capacity to 20,000-28,000 barrels per day. Overall, the leak containment strategy that BP was required to develop projects containment capacity expanding to 40,000-53,000 barrels per day by the end of June and 60,000-80,000 barrels per day by mid-July.

"This estimate brings together several scientific methodologies and the latest information from the sea floor, and represents a significant step forward in our effort to put a number on the oil that is escaping from BP's well," said Energy Secretary Steven Chu. "As we continue to collect additional data and refine these estimates, it is important to realize that the numbers can change. In particular, the upper number is less certain - which is exactly why we have been planning for the worst case scenario at every stage and why we are continuing to focus on responding to the upper end of the estimate, plus additional contingencies."

Today's improved flow rate estimate brings together the work of several scientific teams and is based on a combination of analyses of high resolution videos taken by ROVs, acoustic technologies, and measurements of oil collected by the oil production ship together with pressure measurements inside the top hat. Over the weekend, at the insistence of Secretary Chu and the science team, pressure meters were added to the top hat to assist with these estimates.

The scientists stressed the need for continued and refined pressure measurement, but emphasized that today's improved estimates have a greater degree of confidence than estimates that were possible prior to the riser cut. There are several reasons for this, including:

1. **More and different kinds of data is available now:** The improved estimates are informed by newly available, detailed pressure measurements from within the Top Hat taken over the past 24 hours. In addition, scientists could draw on more than a week of data about the amount of oil being collected through the top hat.
2. **A single flow is easier to estimate:** Prior to the riser cut, oil was flowing both from the end of the riser and from several different holes in the riser kink. This made estimates - particularly based on two dimensional video alone - more difficult.

"We need to have accurate and scientifically grounded oil flow rate information both for the purposes of the response and recovery and for the final investigation of the failure of the blowout preventer and the resulting spill," said Interior Secretary Salazar. "This estimate, which we will continue to refine as the scientific teams get new data and conduct new analyses, is the most comprehensive estimate so far of how much oil is flowing one mile below the ocean's surface."

"Each of the methodologies that the scientific teams is using has its advantages and shortcomings, which is why it is so important that the scientific teams have taken several approaches to solving this problem," said Dr. McNutt. "Under the leadership of Admiral Allen, we will continue to revise and refine the flow rate estimate as our scientific teams get new data and conduct additional analyses."

The FRTG was assembled at the direction of National Incident Commander Admiral Thad Allen, and is led by United States Geological Survey Director Dr. Marcia McNutt. The FRTG, and a scientific team led by Energy Secretary Steven Chu, continue to analyze new data and use several scientific methodologies to develop updated estimates of how much oil is flowing from BP's leaking oil well in the Gulf of Mexico.

For information about the response effort, visit DeepwaterHorizonResponse.com (http://www.deepwaterhorizonresponse.com/) .

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bp

Douglas J. Suttles
Chief Operating Officer

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501 WestLake Park Boulevard
Houston, TX 77079
Direct 281 366 3669
Fax 281 366 7239
Doug.Suttles@bp.com

July 6, 2010

Rear Admiral James A. Watson
Federal On-Site Coordinator
United States Coast Guard

Re: Source Control Subsea Dispersant Forward Plan

Dear Admiral Watson,

This letter is in response to your request that BP Exploration & Production Inc. ("BP") provide a high-level description of its plans going forward with regard to the use of dispersants. Specifically, you asked that we describe BP's planned dispersant use after the improvements to the containment system by the implementation of the Helix producer concept.

BP is moving forward with the installation of the Free Standing Riser 1 system that BP projects will have the capacity to contain an additional 20 - 25 MMBOPD from the MC252 well (the "Well") to the Helix Producer. The current weather conditions make the timing for the start-up of the Helix Producer system uncertain. The earliest projected date for the start-up is July 7, 2010, with it being more likely that the date will be around July 10, 2010. BP anticipates it will take approximately 5 days after the start-up of the Helix Producer system for it to stabilize to the point that we will know how effective it will be at containing the flow from the Well.

As a general principle, (under all conditions the use of subsea dispersant will be held under the 15,000 gallon limit in accordance with the May 26, 2010, Dispersants Monitoring and Assessment Directive) the more effective the Helix Producer system is in containing the flow from the Well, the less subsea dispersant it will be used. If the addition of the Helix Producer system virtually eliminates the escape of oil into the sea, BP will be able to suspend the application of subsea dispersant altogether. However, under this circumstance, BP believes it is critical that we maintain the capability to apply subsea dispersant to meet unforeseen contingencies such as weather disruptions or equipment failures.

If there is still flow from the Well escaping into the sea after installation of the Helix Producer system at a significantly reduced rate, BP will continue to apply subsea dispersant at a proportionately reduced rate. The attached table updates our 6 June 2010 document entitled GoM Drilling, Completions and Interventions- MC252: Guidance on Subsea Dispersants Application OPS Note #3 based on the monitoring and performance data that has been collected. For safety reasons, in accordance with current practices, BP plans to maintain the ability to apply surface dispersant capability as required for prompt VOC control in the case of operational difficulty.

Please let me know if there is any additional information we can provide regarding BP's planned dispersant use.

Sincerely,

Douglas J. Suttles

Approval granted subject to the above:

J. F. Watson

Date: 7-11-10

Jim Watson
Rear Admiral, USCG
Federal On-Scene Coordinator

Attachment 1

- Assume flow rate of 53,000 bbls/day
- Calculate oil escaping by subtracting oil captured by containment system from 53,000 bbls/day
- Apply dispersant at dispersant to oil ratio of 1:75
- Line shows not to exceed 15,000 gallons

Estimated Volume of Oil Captured by Containment Systems (000s barrels per day)	Target EC9500A Subsea Dispersant Application Rate (gallons per minute)[1]
Total Containment	0
> 45	3
40 to 45	4
35 to 40	6
30 to 35	8
25 to 30	10

[1]Averaged over 24-hour period

bp

Douglas J. Suttles
Chief Operating Officer

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501 WestLake Park Boulevard
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Direct 281 366 3969
Fax 281 366 7239
Doug.Suttles@bp.com

July 11, 2010

Rear Admiral James A. Watson
Federal On-Scene Coordinator
United States Coast Guard

Exemption to Dispersant Monitoring and Assessment Directive – Addendum 3

Dear Admiral Watson,

BP respectfully requests an exemption to the Directive's maximum daily application of subsea dispersant for Sunday, July 11, 2010. Consistent with the Capping Stack Installation Plan sent to Admiral Allen on July 9, 2010, we are currently injecting 12 gallons per minute of subsea dispersant into the exiting oil stream. This is to ensure safe working conditions for the +1400 people on vessels working near the source. While we will continue to adjust the dispersant injection rate based upon winds, observed VOCs and oil capture volume, if we maintain 12 gpm, we will exceed 15,000 gallons for July 11.

An increase in subsea dispersant use is consistent with the Guidance on Subsea Dispersant Application you signed on June 23, which states, "For the purpose of VOC control, increases in the application rate of subsurface dispersants will be limited to conditions where winds are weak (< 10 knots) or VOC readings indicate potential health concerns. While this authority is granted to the OSC in the National Contingency Plan, all attempts will be made to maintain the 15,000 gallon per day subsurface cap outlined in Addendum 3 of the Dispersant Monitoring and Assessment Directive." The increase in subsea dispersant is also consistent with the Source Control Subsea Dispersant Forward Plan signed by Doug Suttles on July 6 and awaiting your signature. Assuming a flow rate of 53,000 bbls/day, a capture rate of 8,000 bbls/day, and a dispersant to oil ratio of 75 as stipulated by the USCG and EPA, the target daily dispersant volume would be 25,200 gallons or 17.5 gallons/minute.

The amount of subsea dispersant needed for VOC control has many controlling factors, including oil containment volume, wind conditions, and ocean currents. As you are aware, the amount of oil being captured decreased by ~18,000 barrels yesterday when the previous cap was removed. While we continue to bring the Helix Producer on line as quickly as is safely and operationally prudent, until it is operational, the amount of oil coming to the surface is greater than it has been recently. Additionally, winds are less than 10 knots today and the NOAA forecast is for winds to continue to be light. Finally, while ocean currents are currently bringing the oil to the surface to the southeast of the central operational area, if this current shifts or dissipates, the oil could revert to coming up directly under the main operational area, increasing the risk of VOCs.

Consistent with all of the above, we are requesting an exemption from the 15,000 gallon limit for July 11, 2010. Unless we see an increase in VOCs, we intend to hold our subsea dispersant rate at approximately 12 gpm, which would result in a total volume for today of less than 20,000 gallons. Further, the Helix Producer should begin capturing oil today, and thus we expect we will only need a one day exemption to proactively prevent dangerous VOC conditions during this time of crucial operations near the source.

Sincerely,

Douglas J Suttles RTF

Douglas J. Suttles

Approval granted subject to the above:

J A Watson

Date: 7-11-10

Rear Admiral James A. Watson
Federal On-Scene Coordinator
United States Coast Guard

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DATE: August 2, 2010 5:18:46 PM CDT

U.S. Scientific Teams Refine Estimates of Oil Flow from BP's Well Prior to Capping

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- Report oiled wildlife: (866) 557-1401

Deepwater Horizon Incident Joint Information Center

Phone: (713) 323-1670
(713) 323-1671

WASHINGTON – Based on new pressure readings, data, and analysis, the U.S. scientific teams charged by National Incident Commander Thad Allen with determining the flow of oil from BP's leaking well have refined their estimates of the oil flow prior to the well being capped on July 15. Today's estimates, which draw heavily on recent oil reservoir modeling and on pressure readings of a closed system, are the most accurate to date and have an uncertainty of plus or minus approximately 10 percent.

The scientific teams estimate that 53,000 barrels of oil per day were leaking from BP's well immediately preceding its closure via the capping stack.

Recent measurements and modeling also show that, as a result of depletion of the hydrocarbon reservoir, the daily flow rate decreased over the 87 days prior to the well's closure. Based on these measurements and modeling, the scientific teams estimate that, at the beginning of the spill, 62,000 barrels of oil per day were leaking from the well.

Overall, the scientific teams estimate that approximately 4.9 million barrels of oil have been released from the well. Not all of this oil and gas flowed into the ocean; containment activities conducted by BP under U.S. direction captured approximately 800,000 barrels of oil prior to the capping of the well.

The new estimates reflect the collaborative work and discussions of the National Incident Command's Flow Rate Technical Group (FRTG), led by United States Geological Survey (USGS) Director Marcia McNutt, and a team of Department of Energy (DOE) scientists and engineers, led by Energy Secretary Steven Chu.

At meetings on July 30 and July 31, the group of federal and independent scientists and engineers discussed new analyses and data points to provide the updated range, relying heavily on newly available pressure readings from the new containment cap. An estimation of how much the flow rate has decreased over time was enabled by observing the pressure at shut in and by initial pressure estimates for the well when it was first drilled.

"The revised estimates are part of this Administration's ongoing commitment to ensuring that we have the most accurate information possible," said Secretary Chu. "I am grateful to the scientists and engineers who have worked diligently to help us meet that goal."

"The new containment cap and the well integrity testing procedures have provided new data and new opportunities to firm up some of the unknowns and narrow in on a more refined estimate," said Dr. McNutt. "I appreciate the tireless work of scientists inside and outside of government who are lending their expertise in service to their country and bringing the best science to bear on this effort."

Today's improved flow rate estimate brings together the work of several scientific teams and is based on a combination of analyses of high resolution videos taken by ROVs, measurements and modeling of reservoir and well properties, acoustic technologies, and measurements of oil collected by the oil production ship together with pressure measurements inside the containment cap.

The installation of a new containment cap and the subsequent well integrity testing procedure provided the opportunity to calculate the flow by measuring the pressure at the top of the well as the choke and kill valves were manipulated after the main containment valve was closed to trap hydrocarbons.

During the course of the BP Deepwater Horizon oil spill, U.S. scientific teams have continually updated and refined their flow rate estimates based on the best available information and analysis. Government scientists will continue to analyze data and may in time be able to further refine this estimate.

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