



# National Transportation Safety Board

Washington, D.C. 20594

## Safety Recommendation

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**Date:** February 2, 2009

**In reply refer to:** H-08-13 and -14

Ms. Rose A. McMurray  
Acting Deputy Administrator  
Federal Motor Carrier Safety Administration  
1200 New Jersey Avenue, S.E.  
Washington, D.C. 20590

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Between 1:58 a.m. and 1:59 a.m. on Sunday, October 16, 2005, an accident comprising two events occurred on Interstate Highway 94 (I-94) near Osseo, Wisconsin.<sup>1</sup> The first event was the single-vehicle rollover of a truck-tractor semitrailer combination unit. The second event occurred when a motorcoach collided with the wreckage from the first event.

About 7:30 p.m. on October 15, 2005, a 22-year-old truck driver departed Munster, Indiana, on an approximately 436-mile-long trip to Minneapolis, Minnesota, driving a truck-tractor semitrailer operated by Whole Foods Market, Inc. (Whole Foods). By 1:58 a.m., the truck driver had completed about 323 miles of his trip. The combination unit was traveling westbound on I-94 near milepost 85, at a police-estimated speed of 63 to 69 mph, when the unit departed the right-hand travel lane and paved shoulder at an approximate 3-degree angle. The unit left the roadway and entered the earthen, sloped roadside. The driver steered to the left, and the combination unit reentered the pavement and overturned onto its right side, sliding to a stop so that it blocked both westbound lanes and shoulders of I-94. The truck driver said that following the overturn, he turned off the ignition and was then thrown into the sleeper berth area by another impact.

About 3 hours before this accident, a group of marching band members from Chippewa High School left the University of Wisconsin near Whitewater on an approximately 225-mile-long trip back to Chippewa Falls, Wisconsin. The group was traveling in four motorcoaches and had completed about 195 miles of the return trip. The accident vehicle, a 1993 Motor Coach Industries DL-3 55-passenger-capacity motorcoach owned by Chippewa Trails, Inc., was in the lead. It was traveling westbound in the right-hand lane of I-94

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<sup>1</sup> For more information, see *Truck-Tractor Semitrailer Rollover and Motorcoach Collision With Overturned Truck, Interstate Highway 94, Near Osseo, Wisconsin, October 16, 2005*, Highway Accident Report NTSB/HAR-08/02 (Washington, DC: NTSB, 2008), available on the National Transportation Safety Board's website at <http://www.nts.gov/publicctn/2008/HAR0802.pdf>.

at an estimated speed of between 64 and 78 mph when it collided with the bottom of the overturned combination unit about 1:59 a.m.

The motorcoach driver and four passengers were fatally injured. Thirty-five passengers received minor-to-serious injuries, and five passengers were not injured. The truck driver received minor injuries.

The National Transportation Safety Board determined that the probable cause of the truck-tractor semitrailer rollover, the precipitating event in the accident sequence, and the motorcoach's subsequent collision with the truck, was the truck driver's falling asleep at the wheel, drifting from the roadway, and losing control of his vehicle. The truck driver was most likely fatigued because he did not take full advantage of adequate rest opportunities provided to him during his off-duty time and, as a result, obtained inadequate and disrupted sleep prior to the accident. The motorcoach collided with the overturned truck because there were insufficient visual cues to permit the driver to identify the truck wreckage in time to avoid the collision.

Among the issues raised by this accident were the fatigue of the truck driver and possible means of mitigating the effects of fatigue, such as technologies to detect and counter fatigue and fatigue education efforts.

### ***Driver Fatigue***

The reconstruction of the truck driver's activities revealed that in the 2 days before the accident, his schedule provided him reasonable opportunity to sleep, but on the basis of his self-reported activities, he obtained (at most) 12.5 hours of sleep in this period. He reported that he slept on October 14 for about 7.5 hours (from 9:00 a.m. to 4:30 p.m.). This opportunity to sleep occurred in Minnesota, before he returned home to Indiana, and took place in the truck's sleeper berth. The driver's second sleep opportunity period would have been at home from about 6:00 a.m.<sup>2</sup> to 10:57 a.m. (5 hours) on October 15, the day before the accident. Other than the driver's self-reported information, the Safety Board has no corroboration for whether the driver actually slept during these two periods. The driver had the opportunity to obtain more sleep in these 2 days because he was off duty for about 20 hours.

On average, people need about 8 hours of sleep per night. Sleep deprivation, which is cumulative over time, can make a person susceptible to fatigue. Circadian desynchronization, that is, being awake when one is typically asleep or being awake during the early morning hours when the body is inclined to sleep, can also lead to sleepiness and fatigue. The accident occurred at 1:58 a.m., a time at which the body is predisposed to sleep.

The truck driver said that he had been out with friends in the night and early morning hours on the day before the accident and that he had consumed alcohol at that time. Alcohol has a sedating effect, meaning that the onset of sleep may occur quickly after an individual has consumed it; however, alcohol is also disruptive to sleep, causing individuals to wake up

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<sup>2</sup> The driver told police that he had returned home at 2:00 a.m.; the Wisconsin State Patrol found that he had not returned to his home until 6:00 a.m.

frequently during the second half of the sleep period. Thus, alcohol consumption reduces the quality of sleep and may lead to daytime fatigue and sleepiness.<sup>3</sup>

The Safety Board concludes that the truck driver was asleep at the time of the accident because of the reduced quantity of his sleep; the reduced quality of his sleep due to alcohol consumption the previous night; and the circadian desynchronization he experienced due to his operating the truck in the early morning hours, when the body is predisposed to sleep.

The driver had been driving this route for about 3 weeks. It was a regular run in which the driver picked up a load at the Whole Foods Midwest distribution center in Munster, Indiana, and brought it to the St. Paul, Minnesota, area. Between runs, the driver was off duty. Prior to the accident trip, the driver had been off duty for 20 hours, in which he could have slept if he had chosen. According to the driver's own report of his activities and his cellular phone records, he slept during the off-duty time preceding his scheduled run for 5 hours, at most. Therefore, the Safety Board concludes that the Midwest distribution center of the motor carrier Whole Foods provided an adequate off-duty period for the Osseo truck driver to obtain sufficient sleep, but he did not take full advantage of this opportunity.

### ***Fatigue Technologies***

Before the truck left the roadway, other drivers observed the truck driver having difficulty maintaining lane alignment and repeatedly drifting out of his lane. Lane departure warning systems (LDWS) monitor the location of the vehicle within the lane and alert the driver when the vehicle drifts from the lane. Research results have shown that LDWSs decrease lane departures, and system users have reported that LDWSs help them to maintain their vehicles' lane positions.<sup>4</sup> The Federal Motor Carrier Safety Administration (FMCSA) has developed voluntary standards for LDWSs that include standards for functional, data, hardware and software, driver-vehicle interface, and maintenance and support requirements.<sup>5</sup>

Other systems that monitor the vehicle, such as steering position monitors, as well as systems that monitor driver behavior, have also been developed to detect fatigue. One of the most promising driver-monitoring systems is PERCLOS, which measures the rate of eyelid closure. The National Highway Traffic Safety Administration (NHTSA) is conducting a field operational test to evaluate the effectiveness of PERCLOS in assessing driver fatigue.

The Safety Board recently completed investigations of two other accidents that resulted because of driver fatigue. In the Lake Butler, Florida, accident, a tractor-trailer collided with a Pontiac Bonneville and a school bus, killing all seven occupants of the passenger car and injuring the nine bus passengers and bus driver.<sup>6</sup> This accident occurred on January 25, 2006, at 3:25 p.m.

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<sup>3</sup> (a) National Institute on Alcohol Abuse and Alcoholism, *Alcohol and Sleep*, Alcohol Alert No. 41, 1998. (b) National Sleep Foundation. (c) National Highway Traffic Safety Administration *Sleep* brochure.

<sup>4</sup> (a) *Evaluation of the Mack Intelligent Vehicle Initiative Field Operational Test*, FMCSA-06-016. (b) Status report on U.S. Department of Transportation project, "An intelligent vehicle initiative road-departure crash warning field operational test."

<sup>5</sup> Federal Motor Carrier Safety Administration, *Concept of Operations and Voluntary Operational Requirements for Lane Departure Warning Systems (LDWS) On-Board Commercial Motor Vehicles*, July 2005.

<sup>6</sup> National Transportation Safety Board, *Rear-End Chain-Reaction Collision, State Route 121, Near Lake Butler, Florida, January 25, 2006*, Highway Accident Brief NTSB/HAB-08/05 (Washington, DC: NTSB, 2008).

Reconstruction of the truck driver's work/rest history showed the truck's Qualcomm<sup>7</sup> signal was lost at 8:23 p.m. on January 23 and resumed about 9 hours later, the next morning, January 24, about 34 hours before the accident. This was the last opportunity the driver had for an extended sleep period before the accident. With the exceptions of a 2-hour sleep period beginning around 1:00 a.m. on January 25 and 1 to 2 hours of rest a few hours later, about 7:00 a.m., the truck driver was awake for about 30 hours during this 34-hour period. The Safety Board determined that the probable cause of the accident was the failure of the truck driver to maintain alertness due to fatigue from obtaining inadequate rest. Contributing to the accident was the failure of the motor carrier to exercise proper oversight of the driver's hours of service.

On October 9, 2004, a 1988 47-passenger motorcoach transporting 29 passengers to a casino in Tunica, Mississippi, was traveling southbound on Interstate Highway 55 near Turrell, Arkansas.<sup>8</sup> At exit 23A, the motorcoach veered to the right and entered a grassy area between the exit and entrance ramps. The motorcoach overturned onto its left side. The accident resulted in 15 fatalities and 15 injuries. The Turrell motorcoach driver had been awake approximately 19 hours at the time of the accident. He had been on duty for about 9 hours and had been driving for the last 8 hours. He had made two brief stops at rest areas to let passengers use the restrooms. Although the driver had obtained a full night's sleep the night preceding the accident and had taken a nap during the day, the scheduling of the trip deprived him of his customary nighttime sleep period. The Safety Board determined that the motorcoach driver's fatigued condition caused him to allow his vehicle to drift off the left side of the roadway, contacting the rumble strips. He reacted to the warning provided by the rumble strips by oversteering the motorcoach to the right and then off the roadway.

Fatigue technologies are designed to monitor driver behaviors such as eyelid closure or head position, or vehicle actions such as steering wheel input or lane drift. The U.S. Department of Transportation (USDOT) has been examining fatigue detection systems, and the research has shown promising results regarding the effectiveness of fatigue detection systems. Had fatigue monitoring devices been available in the vehicles in the Osseo, Lake Butler, and Turrell accidents, it is possible that the accidents could have been prevented. Such on-board devices could have signaled the drivers that their alertness was diminishing, both helping to increase their alertness in the short term and prompting them to seek opportunities to rest safely. Specifically, the Safety Board concludes that had the Osseo truck-tractor semitrailer been equipped with technologies to detect fatigue, the systems might have prevented or mitigated the severity of the fatigue-related crash. Therefore, given the likelihood that technologies to detect fatigue could make fatigued drivers more aware of their condition and given that driver fatigue is a major cause of or factor in accidents (as shown in the 2007 FMCSA large truck crash causation study),<sup>9</sup> the Safety Board recommends that the FMCSA develop and implement a plan to deploy technologies in commercial vehicles to reduce the occurrence of fatigue-related accidents.

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<sup>7</sup> The Qualcomm Qtracs system uses a transmitter/receiver that allows objects to be continually tracked through global positioning satellites. The system identifies the location of each truck every hour, as well as the corresponding time and date and whether the truck engine is running.

<sup>8</sup> National Transportation Safety Board, *Motorcoach Run-Off-the-Road and Rollover, Interstate 55 Near Turrell, Arkansas, October 9, 2004*, Highway Accident Brief NTSB/HAB-08/04 (Washington, DC: NTSB, 2008).

<sup>9</sup> U.S. Department of Transportation, Federal Motor Carrier Safety Administration, *Large Truck Crash Causation Study: Analysis Brief*, FMCSA-RRA-07-017 (Washington, DC: FMCSA, July 2007).

### ***Fatigue Education***

Fatigue detection technologies are designed to alert the fatigued driver who is already on the roadway. Educational and regulatory efforts are intended to keep fatigued drivers off the roadways. The Safety Board has issued several recommendations related to education and driver fatigue. In 1989, the Safety Board issued intermodal Safety Recommendation I-89-2, which asked the USDOT to do the following:

Develop and disseminate educational material for transportation industry personnel and management regarding shift work; work and rest schedules; and proper regimens of health, diet, and rest.<sup>[10]</sup>

In its 1995 study on fatigue in heavy truck accidents,<sup>11</sup> the Safety Board asked the Federal Highway Administration (FHWA) to develop and disseminate a training and educational module to inform truck drivers of the hazards of driving while fatigued (Safety Recommendation H-95-5). In 1999, the Board asked the FHWA to ensure that the dangers of inverted sleep periods were discussed in the fatigue video being developed for motorcoaches (Safety Recommendation H-99-4a). The USDOT published a 1995 report, *Sharing the Knowledge: Department of Transportation Focus on Fatigue*, and produced two videotapes that addressed fatigue. The FHWA and the American Trucking Associations, Inc., adapted an aviation training module for use within the commercial driving industry. The USDOT also developed a train-the-trainer course on fatigue and fatigue countermeasures.<sup>12</sup> The FHWA was involved in the development and dissemination of the brochure *Awake at the Wheel*. Other organizations, including the National Sleep Foundation and the AAA Foundation for Traffic Safety, have also produced educational materials for use by commercial motor vehicle drivers. The FMCSA developed a motorcoach driver fatigue video that addressed the dangers of inverted duty and sleep periods. Safety Recommendations I-89-2, H-95-5, and H-99-4a are classified “Closed—Acceptable Action.”

The FMCSA is currently involved in the development of a “North American Fatigue Management Program for Commercial Motor Carriers.”<sup>13</sup> This project is a collaborative effort “aimed at reducing fatigue-related accidents and decreasing the personal and economic cost to drivers, companies, and worker’s compensation programs and insurance carriers.”<sup>14</sup> The final

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<sup>10</sup> National Transportation Safety Board, *Head-End Collision of Consolidated Rail Corporation Freight Trains UBT-506 and TV-61 Near Thompsontown, Pennsylvania, January 14, 1988*, Railroad Accident Report NTSB/RAR-89/02 (Washington, DC: NTSB, 1989).

<sup>11</sup> National Transportation Safety Board, *Factors That Affect Fatigue in Heavy Truck Accidents*, Safety Study NTSB/SS-95/01 and NTSB/SS-95/02 (Washington, DC: NTSB, 1995).

<sup>12</sup> The National Aeronautics and Space Administration developed an education and training module titled “Alertness Management in Flight Operations.” Its three primary objectives were to explain (1) the current state of knowledge about the physiological mechanisms that underlie fatigue, (2) the misconceptions about fatigue, and (3) fatigue countermeasures. The aviation program’s rationale was used as the basis of the FHWA/American Trucking Associations training module.

<sup>13</sup> NTSB staff communication with FMCSA staff on June 13, 2008.

<sup>14</sup> The research initiative is sponsored by the FMCSA, Alberta Transportation, Alberta Workers’ Compensation Board, Commission de la Santé et de la Sécurité du Travail du Québec, Société de l’Assurance Automobile du Québec, and Transport Canada. The project is supported by the Alberta Motor Transport Association, American Transportation Research Institute, Association du Camionnage du Québec, Canadian Trucking Alliance, and Canadian and U.S. volunteer motor carriers and drivers taking part in operational tests.

product, a “best practices manual,” is intended to have several components, including the following:

- *Company Ownership of the Fatigue Management Plan (FMP)*. Such an outcome involves management support, as well as an empowered FMP-coordinating group within the company, which can provide guidance and support to the organization.
- *Education and Training*. Materials will provide general information on a variety of subjects including fatigue, sleep, and sleep disorders; health and wellness; and trip planning. The educational component will also include a system to track participant progress. In addition, refresher and supplemental materials, such as newsletters or updates, will be distributed to reinforce the information already learned and to ensure ongoing commitment to the program.
- *Scheduling Policies and Practices*. The company’s existing scheduling policies and practices will be evaluated for inherent fatigue-related risk, and the principles of effective fatigue management will be applied while continuing to maintain effective service.
- *Sleep Disorders Screening and Treatment*. This section of the manual will provide guidance to carriers and drivers about medical factors that may contribute to workplace fatigue. Sleep disorders screening and treatment will be addressed.
- *Compliance and Review*. Evaluation of the quality and effectiveness of the program is to be ongoing. This will require data collection and incident reporting. Guidelines for followup action to incidents for communicating “lessons learned,” as well as for implementing changes for future situations will be supplied in the FMP.

The North American Fatigue Management Program for Commercial Motor Carriers calls for evaluation of FMPs at the motor carrier level. Evaluation is intended to determine how well each FMP is working for its individual carrier. However, the FMCSA, as the Federal agency responsible for commercial vehicle safety, must also be involved in the evaluation of the FMPs to determine whether they successfully mitigate fatigue and how to make the programs more successful. The Safety Board recognizes that the North American Fatigue Management Program for Commercial Motor Carriers is currently being tested in an operational setting but considers that the assessment process should be continual. The Safety Board concludes that for FMPs to be successfully implemented by motor carriers over time, FMCSA oversight is needed. Therefore, the Safety Board recommends that the FMCSA develop and use a methodology that will continually assess the effectiveness of the FMPs implemented by motor carriers, including their ability to improve sleep and alertness, mitigate performance errors, and prevent incidents and accidents.

### ***Hours-of-Service Compliance***

Federal regulations (49 *Code of Federal Regulations* [CFR] 395.8) require drivers to maintain a record of their status, in duplicate, either by using an approved log grid or an automatic on-board recording device, and to keep the records current. The truck driver in the Osseo accident was not maintaining a driver log. Furthermore, Federal regulations

(49 CFR 395.8 [a]) require that motor carriers require their drivers to record their duty status for each 24-hour period, using either an approved log grid or an automatic on-board recording device. In the Osseo accident, a postaccident compliance review found that the motor carrier Whole Foods had violated several hours-of-service (HOS) regulations.<sup>15</sup> Postaccident compliance reviews of the motor carriers involved in the 2006 Lake Butler, Florida, and 2004 Turrell, Arkansas, accidents indicated that those carriers also had violated logbook regulations.

For more than 30 years, the Safety Board has been issuing recommendations with respect to its concern that driver logs do not provide an efficient and reliable means of tracking the number of hours a commercial driver drives. In 1977, the Safety Board issued its first recommendation on the use of on-board recording devices for commercial vehicles (Safety Recommendation H-77-32). Since then, the Safety Board has issued additional recommendations concerning the use of on-board recorders (Safety Recommendations H-90-28 and -48 and Safety Recommendations H-98-23 and -26), but they have not been implemented.<sup>16</sup> Most recently, during an investigation of a multiple-vehicle accident that took place near Chelsea, Michigan,<sup>17</sup> the Safety Board discovered two versions of the driver's logs. The Safety Board issued Safety Recommendation H-07-41 to the FMCSA, asking that it do the following:

Require all interstate commercial vehicle carriers to use electronic on-board recorders that collect and maintain data concerning driver hours of service in a valid, accurate, and secure manner under all circumstances, including accident conditions, to enable the carriers and their regulators to monitor and assess hours-of-service compliance.

In its initial response, the FMCSA noted that it had a rulemaking on electronic on-board recorders (EOBR) under way; the notice of proposed rulemaking (NPRM) had been published on January 18, 2007.<sup>18</sup> The NPRM focused on three elements: (1) performance-oriented standards for EOBRs, (2) mandatory use of EOBRs only for those motor carriers found to exhibit a pattern of violations of HOS regulations, and (3) development of incentives expected to encourage voluntary industrywide use of EOBRs. In its April 18, 2007, comments concerning this NPRM, the Safety Board expressed its general satisfaction regarding the performance standards for EOBRs, its disappointment that the NPRM did not propose mandatory EOBR use by all operators subject to HOS regulations, and its concern that the incentives proposed in the NPRM would not be strong enough to override the financial motivation that some carriers and drivers have for continuing to circumvent the HOS regulations and not use EOBRs. The Safety Board urged the FMCSA to revise the NPRM to require that all motor carriers subject to the HOS regulations install and use EOBRs.

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<sup>15</sup> The violations included that Whole Foods had required or permitted a property-carrying commercial motor vehicle (CMV) driver to drive more than 11 hours, required or permitted a property-carrying CMV driver to drive after the end of the 14th hour after coming on duty, required or permitted a property-carrying CMV driver to drive after having been on duty more than 70 hours in 8 consecutive days, made a false report of records of duty status, failed to require a driver to prepare a record-of-duty status, and failed to preserve a driver's record-of-duty status for 6 months.

<sup>16</sup> These four recommendations are all classified "Closed—Unacceptable Action."

<sup>17</sup> National Transportation Safety Board, *Rear-End Chain Reaction Collision, Interstate 94 East, Near Chelsea, Michigan, July 16, 2004*, Highway Accident Brief NTSB/HAB-07/01 (Washington, DC: NTSB, 2007).

<sup>18</sup> USDOT Docket No. FMCSA-2004-18940.

Also in the Chelsea report, the Safety Board issued Safety Recommendation H-07-42 to the FMCSA, asking that it do the following:

As an interim measure and until industrywide use of electronic on-board recorders is mandated, as recommended in Safety Recommendation H-07-41, prevent log tampering and submission of false paper logs by requiring motor carriers to create and maintain audit control systems that include, at a minimum, the retention of all original and corrected paper logs and the use of bound and sequentially numbered logs.

In its response to the recommendation, the FMCSA indicated it did not believe an interim rulemaking was necessary. Instead, the FMCSA believed it would be better to focus its efforts on the EOBR NPRM and the proposed mandate to require EOBRs on only a limited number of motor carriers, which it said would advance safety more than efforts to improve handwritten records. Safety Recommendations H-07-41 and -42 are currently classified “Open—Unacceptable Response.”

The Safety Board continues to believe that drivers should maintain reliable, accurate, and verifiable status-of-duty records and that motor carriers are responsible for ensuring that records are maintained. EOBRs would ensure that drivers and carriers have accurate and valid HOS information available to them. Based on the Osseo investigation, the Safety Board concludes that the Osseo truck driver and the Midwest distribution center of Whole Foods failed in their responsibilities to maintain status-of-duty records. The Safety Board further concludes that mandating the use of EOBRs by all interstate commercial vehicle carriers would ensure the availability of valid, accurate, and secure HOS data, which could result in increased compliance with HOS regulations. Implementation of Safety Recommendation H-07-41 would ensure that motor carriers such as Whole Foods have EOBR-collected HOS data available for all their drivers, which would enable the carriers to monitor and assess the HOS compliance of their drivers quickly and efficiently. The Safety Board encourages the FMCSA to implement Safety Recommendation H-07-41 as soon as possible.

Therefore, the National Transportation Safety Board makes the following safety recommendations to the Federal Motor Carrier Safety Administration:

Develop and implement a plan to deploy technologies in commercial vehicles to reduce the occurrence of fatigue-related accidents. (H-08-13)

Develop and use a methodology that will continually assess the effectiveness of the fatigue management plans implemented by motor carriers, including their ability to improve sleep and alertness, mitigate performance errors, and prevent incidents and accidents. (H-08-14)

The Safety Board also issued one safety recommendation and reiterated two safety recommendations to the National Highway Traffic Safety Administration and issued one safety recommendation to Whole Foods Market, Inc.

In response to the recommendations in this letter, please refer to Safety Recommendations H-08-13 and -14. If you would like to submit your response electronically

rather than in hard copy, you may send it to the following e-mail address: [correspondence@ntsb.gov](mailto:correspondence@ntsb.gov). If your response includes attachments that exceed 5 megabytes, please e-mail us asking for instructions on how to use our Tumbleweed secure mailbox procedures. To avoid confusion, please use only one method of submission (that is, do not submit both an electronic copy and a hard copy of the same response letter).

Acting Chairman ROSENKER and Members HERSMAN, HIGGINS, SUMWALT, and CHEALANDER concurred in these recommendations. Member HIGGINS filed a concurring statement, which is attached to the highway accident report.

*[Original Signed]*

By: Mark V. Rosenker  
Acting Chairman