U.S. Department
of Transportation

**Federal Railroad
Administration**

1120 Vermont Ave., N.W.
Washington, D.C. 20590

SEP 9 2005

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Dear Sirs:

By letter dated September 2, 2003, the Senate Committee on Commerce, Science, and Transportation (Committee) requested that the Federal Railroad Administration (FRA) conduct an audit of "the railroads' use of remote control locomotives (RCLs) and the effect of further implementation of this technology." The letter goes on to say that

> [t]he audit should include an assessment of the impact of RCLs on safety, including a comparison of the rate of accidents, injuries, and fatalities involving RCLs with similar operations involving manned locomotives. Additionally, the audit should assess the effects of remote control operations on the safety of highway rail grade crossings, hazardous materials transportation, the safety of remote control locomotives operated in urban areas, any unique operating characteristics presented by RCLs, and an assessment of the safety benefits of such operations. The report should include any recommendations for legislative or regulatory changes FRA determines necessary. We request that FRA report back to the Committee with preliminary findings and initial accident statistics within 6 months, and that a detailed final report is submitted within 18 months.

We are writing to advise you that this audit and an associated review have resulted in two determinations that are of immediate interest to your members. Both relate to the use of RCL technology in main line train movements. The first concerns the suitability of the technology in the context of non-incidental main line train movements and gives rise to specific recommendations. These recommendations supplement FRA's Safety Advisory 2001-1 (Advisory). The second determination has to do with the adequacy of training providing RCL operators engaged in non-incidental main line movements and will be addressed with individual railroads in context of review of their programs of training subject to approval under 49 CFR Part 240.

In May 2004, FRA submitted the required interim report to Congress. Preliminary data prepared for that report indicated that the safety record of RCL operations over the seven-month period May 1, 2003, through November 30, 2003, had been positive. However, the report listed four items that were left open pending further review. One of those items was an operating practices issue entitled, "RCL operations outside of yard switching operations." Interim Report at 9-10.

In the interim report, FRA explained that the Advisory was intended to address RCL use in yard switching operations and how we were surprised to learn that railroads had some RCL operations on main tracks. Most of the RCL main track movements were found to be "incidental" as they were short switching movements, with limited numbers of cars and the remote control operators (RCO) were appropriately trained.

Now that we have had an additional year to study the issue, we continue to believe that these incidental main track movements by RCLs are generally safe, and we will not object to them unless we identify a specific safety concern.

Likewise, an additional year of monitoring and evaluating the non-incidental movements by RCLs over main track has reaffirmed our initial concerns that, given the limitations of RCL technology, non-incidental movements over main track by RCLs can pose an unacceptable safety risk and thus should be strictly limited. Further, it appears that RCO training provided to date is not sufficient to support non-incidental main line operations.

The primary problem with the current state of the RCL technology is that it is inadequate to control in-train forces during heavy-haul operations; similarly, we are concerned that the way to operate the RCL over the main track, and its variously graded conditions, without pulling the train apart, may require manipulating the remote control device in a way that is counter-intuitive to the way it was designed to be used. With regard to training, we have concluded that the typical 80 hours of RCO training that is specified in each railroad's locomotive engineer certification program is inadequate to prepare an RCO for operating an RCL over main track; to conclude otherwise, would permit the absurd situation of allowing an RCO to perform all the same operations as a train service locomotive engineer, just with different equipment and significantly less training. The inadequacy of the current technology and training is further explained below.

Technology

After becoming familiar with the current RCL technology, FRA realized the current systems in use by the major railroads have limitations when used outside the yard environment. For example, FRA's initial concern was that the current technology might not be suitable to control in-train forces during train movements. The speed control feature on the remote control transmitter (beltpack) was originally designed for yard switching operations. The speed control works like an automobile's cruise control. A speed is selected, and the computer will increase locomotive power until the desired speed is reached. The computer will then automatically maintain the selected speed using locomotive power and brakes.

When used for switching, i.e., limited number of cars on a yard-switching lead track with limited horsepower, the system works well. The system is designed to accelerate quickly to facilitate switching cars into classification tracks. When this system is used to haul trains, however, the speed control feature must be circumvented at times to control in-train forces. When starting a train, the computer begins the movement slowly for approximately five to ten seconds, then rapidly applies more horsepower in short intervals to gain the desired speed. The computer is not programmed or designed to make train-handling decisions, i.e., to take into account the number of cars and tonnage that are in the train being moved or the topography of the track over which the train is operating. Consequently, the computer will attempt to start the train too quickly. If locomotive power is not applied gradually, excessive in-train forces could be generated. FRA has observed that some RCOs compensate for this feature by setting the speed control to the coast position (reduces pulling forces) periodically as the train is being started. If the locomotive's rapid acceleration rate is left unchanged, the train may separate due to excessive in-train forces. Separation is likely if the locomotive consist is capable of developing high tractive effort. The system has little ability to apply locomotive power in a gradual, conventional manner, as it was designed for rapid acceleration.

Another area of concern involves the RCL braking system, which is also primarily designed for yard switching movements. All locomotives are equipped with two air brake systems: the locomotive or independent air brake (which controls the air brakes on only the locomotive) and the automatic train air brake (which controls the air brakes on both the locomotive and the cars in the train). As the name implies, the independent air brake operates the locomotive brakes independently of the automatic air brakes. Light locomotive and switching movements are primarily controlled by the independent air brake, whereas trains are primarily controlled by the automatic air brake. The onboard computer controls all movements initially by using the independent air brake. The system is designed to react to speed changes within plus or minus 0.5 miles per hour (mph) of the current speed selection. For example, if the speed control is set at 7 mph, the brakes will apply once the speed exceeds 7.5 mph and will release once the speed drops below 7.5 mph. Conversely, if the speed drops 0.5 mph below the set speed, the computer will direct the locomotive to increase power to maintain the selected speed, which will cause slack action in the train. Since plus or minus fluctuations in speeds greater than 0.5 mph often occur as trains move over the main track, the independent air brake will constantly apply and release, or locomotive power will increase or decrease, causing the train slack to run in and out as the train progresses. The longer and heavier the train, the more dramatic this slack action becomes. While the system is suitable for switching operations, it does not work well during train movements. Depending on locomotive horsepower, train size, and train makeup, excessive slack action in the train could cause a derailment due to excessive in-train forces.

RCOs have the ability to use the automatic air brake to a limited degree, depending on software modifications to the system. The RCL automatic air brake system was originally designed to supplement the locomotive air brakes when stopping heavy drafts of cars in yards. If the locomotive air brake is fully applied and more braking effort is needed to control speed, the speed control feature will make an additional predetermined brake application with the automatic brake. (The automatic air brake system can be used only if the cars being handled have the air hoses coupled between them and the cars are charged with air). Once the movement slows to the

selected speed, the brakes are released. Again, this system works well when handling heavy drafts of cars from one track to another in the yard. This function is not desirable when controlling longer trains on the main track because the computer works faster than the train air brake system. For example, under certain track profiles (short downhill, uphill track configurations), the system could apply and release the brakes before the brakes fully apply on the rear of a long train. This would create a situation where the brakes would be releasing on the head end of the train at the same time they are applying on the rear end. This condition could cause excessive in-train forces.

After considering all the information above, FRA believes that, given sufficient training, an RCO could develop the skills to operate small trains on the main track over flat terrain for limited distances. However, given all the variables that exist (e.g., train tonnage, train length, locomotive horsepower, track terrain), proper train handling could prove difficult for larger trains over greater distances.

FRA does not believe that further modification of RCL technology could overcome these limitations while providing a level of safety equal to that of conventional operations on the main line. FRA is concerned that—under the best of circumstance—signal latency between the beltpack and the RCL would introduce an *additional*, and unnecessary, element of delay between initiation and execution of commands by the operator. The delay, when giving commands to the RCL, may interfere with train handling calculations and decisions, and that is one reason why FRA has taken a conservative view of the acceptable train length this current RCL equipment should handle. Moreover, the "fail-safe" feature that acts to stop the locomotive, when command signal interference ("No Com") is experienced, denies the RCO adequate control over the train movement. For example, there have been incidents in yards where the RCL suddenly stopped because of communication failure and caused a section of the cars being handled to break away. In one instance these cars rolled into the side of a train, causing a derailment. To have such occurrences on high-speed main tracks could prove catastrophic. FRA recognizes that penalty brake applications can and do occur to engineers during conventional main track operations. However, the engineers have the ability to immediately respond to these situations with considerably more controls than those afforded to RCOs. Importantly, there is no sound reason to introduce *additional* causes of undesired air brake applications.

FRA Review of Training Programs

All the major railroad RCL training programs provide a minimum of two weeks of training for railroad employees with no previous experience operating a locomotive. The two-week training period takes into account that the trainees are former conductors with significant railroad experience. Approximately two to three days are spent in the classroom, with the remainder of the time spent in the field as on-the-job training. RCOs receive little additional training in air brakes, train handling, signal recognition, track-train dynamics, etc. These are all subjects associated with the fundamentals of main track operations, regardless of speed or distance. Starting or stopping a train at low speeds is normally the time that in-train forces can be the greatest. Extreme care must be taken during these times. Yard transfer and local freight work

also expose RCOs to a large number of signal aspects and configurations found in multi-terminal areas. RCOs should be as knowledgeable in these subject areas as conventional engineers. Consequently, FRA believes that RCOs should receive additional training if they operate on main tracks.

In FRA's interim report to Congress, FRA recognized how the major railroads defined the duties of an RCO in the programs filed with FRA and noted that these programs, as understood by FRA, did not contemplate extensive movements on main track. Interim Report at 4. In hindsight, it is clear that some railroads take a broader view of the description of RCO duties, and it is therefore appropriate to review their locomotive engineer training programs to determine that required competencies are being addressed.

Accordingly, FRA will, as necessary, reopen review of railroad RCO training programs where it is clear that the railroad is committed to non-incidental main line movements. In initiating this review, FRA will apply the following criteria:

1. RCOs should be required to have the same or the equivalent level of classroom training as that provided for conventional train service engineers on each railroad. Examples of necessary training will likely include railroad safety and operating rules; switchman, trainman, and conductor duties and responsibilities; engineer duties and responsibilities (RCO); and, in many areas, the physical characteristics of multiple-terminal transfer routes.
2. Regarding on-the-job training (OJT), each RCO should have a minimum of 120 hours of actual, documented hands-on operating experience. (Note: FRA is willing to consider a railroad's amended program that credits previously worked hours for those RCOs who have worked main track assignments prior to the implementation of the minimum OJT training requirement). As with all training, railroads should remain flexible and provide more than the minimum of OJT training when necessary; e.g., if the track profile is difficult or the distance poses specific issues, OJT training should be increased on a case-by-case basis.

Although this review will include an opportunity for the railroad to suggest modifications of these criteria as applied to their specific circumstances, FRA will expect substantial improvements to existing RCO training programs where non-incidental main line operations are contemplated.

Recommended Restrictions on Non-Incidental Main Line Movements

In a similar vein to our published minimum guidelines in the Advisory, FRA recommends the following course of action for those railroads that voluntarily choose to conduct RCL operations outside of yard switching operations. In recognition of the existing and inherent technological limitations discussed in this letter, FRA strongly suggests that each railroad should establish standard operating procedures that limit RCL movements outside of yard switching operations. At a minimum, we recommend that the following limitations should apply to all RCL movements requiring brake tests under 49 C.F.R. Part 232:

a. Locomotive consist should not exceed 3000 horsepower, utilizing no more than eight (8) axles.
b. Train length should not exceed 1000 feet (approximately 20 car lengths).
c. Train speed should not exceed 15 mph.
d. Operations should be prohibited on any grade of 0.5 percent or greater that extends for more than ¼ of a mile.

FRA notes that, while these criteria have the status of recommendations and as such are subject to discussion and adaptation, it will be necessary to determine that reasonable limits are being set in practice or FRA will have to take more definitive action.

In summary, FRA has concluded that RCL technology has limited application to main track operations. It is clear that current RCL systems and training programs are designed for yard switching operations and that enhanced training must be provided where non-incidental main line operations are contemplated. Even where RCOs are properly trained and qualified for main line operations, FRA recommends that railroads adopt operational restrictions that reflect the inherent limitations of a system configured for yard operations that rely upon radio-frequency transmission of safety-critical commands.

Because of the importance of this issue to the railroad industry, FRA would appreciate it if you could disseminate the contents of this letter to your member railroads. Your consideration of this matter is greatly appreciated.

Sincerely,

Daniel C. Smith
Associate Administrator for Safety