

Summary of 2012 Investigation of Radio Communication Complaints from RR Radio Pilot Road Users at Chetwynd, BC

RR Radio Pilot Project

**Prepared for the Ministry of Forests, Lands, and Natural Resource
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Executive summary

A new Resource Road (RR) radio protocol is currently under pilot by the Ministry of Forests, Lands and Natural Resource Operations (FLNRO) in the South Peace, Vancouver Island and Sunshine Coast. In early 2012, reports of radio communication problems were received from West Fraser Mills, Chetwynd and a Talisman Energy road maintenance contractor. The complaints were of radio incidents and near misses resulting from poor radio communications but, in most cases, they were not reported in enough detail to diagnose and resolve. A field investigation was conducted in March 2012 by FPInnovations and Industry Canada to document radio communication complaints, and the state of road users' radio hardware and programming. With assistance from FLNRO, the collected information was used to diagnose and offer resolutions for all of the outstanding radio communication issues.

A total of 49 contractors and staff from West Fraser and the Talisman Energy were interviewed about their complaints going back one year and their mobile radio equipment checked for operability. Twenty of those interviewed (41%) reported some form of radio communication difficulty. The investigation confirmed that the most serious complaint was also the most prevalent; incidents of "no communications" at all between some radio users with no explanation why. Complaints of broken communication, cut off calls, and garbled communication were also noted.

The investigation found that communications using tone-squelched channels can be affected in unexpected ways if the *monitor mode* setting is activated on mobile radios and if the users are not trained in its use. In this investigation, three-quarters of interviewed mobile radio users had activated their monitor mode setting with few, if any, understanding the impact on radio function. Monitor mode usage, in combination with an incorrect channel selection, was found to have caused the 'no communication' incidents. Because of the perceived difficulty in regulating the use of the monitor mode setting for mobile radios on RR Radio Protocol roads, it is believed that radio communication issues arising from its interaction with tone-squelched RR channels will continue. Therefore, FPInnovations and Industry Canada recommend the removal of the tone squelching from the RR channel specification. This will eliminate the chance of monitor mode negatively affecting radio communications and still allow certain road users to utilize monitor mode, where required.

Programming issues, such as setting the squelch at too high a level, was also found to contribute to poor communications as did poor installation and maintenance of radio equipment in some vehicles.

The authors recommend that a process be developed to ensure that radio communication incidents are recorded and reported in a timely manner with the appropriate details. Further, that training programs and information be made available to mobile radio users to educate them about radio function, recommended maintenance and installation practices.

Introduction & Background

The Ministry of Forests, Lands and Natural Resource Operations (FLNRO) is conducting a pilot of a new Resource Road (RR) Radio Protocol in three areas of British Columbia: the South Peace, Vancouver Island and the Sunshine Coast. Shortly after the pilots were initiated in 2008, complaints of poor radio performance were reported by a small number of road users—mostly from the Chetwynd area. Complaints were raised about the following radio issues, which were not observed before the pilot began:

- communication difficulties at close range (e.g., <1km)
- no communication at all
- garbled communication at both close and far range
- cut-off calls
- decreased range of radio transmission

The BC Communications Working Group (FLNRO, Industry Canada, FPInnovations) reviewed the complaints and investigated potential causes for the decreased RR channel performance and irregular radio behaviour. The following were identified as potential causes of the problems:

- incorrect radio programming
- radio equipment issues related to installation in a vehicle
- radio equipment issues related to poor radio maintenance
- user errors (e.g., sloppy keying of the mic, wrong channel selected)
- older wideband-only radios interfering with narrowband radios
- inability to find the appropriate channel in the radio in the time available (i.e., while driving between road information sign and new road/ road section)

However, the lack of a formal reporting process hampered investigation and the determination of root causes for these issues. During a field visit in early 2011, FPInnovations staff witnessed mic keying errors by some of the road users on the Moberly FSR. At the time, this was the only evidence which supported complaints for cut-off calls. This problem was corrected once users were aware of their mistakes. The issues regarding “no communication” and “garbled calls” were not as evident because complaints of this nature were too variable, did not include enough detail to be repeated, and the incident records lacked sufficient detail to allow follow-up with the individuals involved. Communication problems leading to near misses continued to occur during 2011 in the South Peace pilot but went unreported to the South Peace Road User Group until early 2012. Chetwynd Forest Industries, West Fraser Mills (West Fraser) and its hauling contractors experienced numerous incidents; FLNRO staff also experienced radio issues in January and February 2012. West Fraser indicated they could no longer support the RR radio pilot, if the near misses and communication problems remained unaddressed. As a result of the numerous complaints on one road tributary of the Moberly FSR, West Fraser and their hauling contractors switched to using an Appendix 6 channel (a wideband frequency with no tones) on the Moberly’s tributary road until the winter haul was completed. They continued to use the RR channels, however, on the Moberly FSR network.

Objective

The purpose of the field visit was to investigate RR pilot-related communication complaints from West Fraser's woodlands staff and their hauling contactors, diagnose the underlying issues and offer solutions where possible. Specifically, the complaints investigated were about broken or garbled radio communications, inability to hear calls between vehicles ("no communication"), and cut-off calls.

Investigation Method

The field investigation took place during the week of March 16 with FPInnovations and Industry Canada staff visiting West Fraser operations at Chetwynd, Talisman Energy, and a local road maintenance company; FLNRO Engineering and FLNRO Radio Operations staff assisted with developing the plans for the investigation and with interpretation of the findings. FPInnovations was tasked with collecting detailed accounts of near misses and communication problems resulting from the use of the RR channels. By methodically gathering information about unresolved radio communication issues linked to the RR radio protocol, it was hoped that root causes could be identified. Industry Canada was tasked with checking for correct radio function and RR channel operability (i.e., correct frequencies, tones, bandwidth and display properties), as well as checking operator licensing.

FPInnovations and Industry Canada personnel performed radio checks and interviewed West Fraser contract haulers in the Chetwynd mill yard. Derek Dyck, West Fraser Harvesting Superintendent, identified candidate truckers to interview, facilitated the radio check and interview process, and ensured compliance with mill yard safety protocols. West Fraser had warned its staff and contractors that the radio checks and interviews might create small delays and requested their cooperation so most fully and willingly participated. Chip trucks and other vehicles that did not travel on Pilot resource roads were not stopped.

During the interview, each driver was asked if he/she had any radio incidents on resource roads within the last year and whether they believed that the incident was related to using the RR Radio Protocol. For the purposes of this report, FPInnovations defines "radio incidents" as a communications failure that resulted in an unexpected encounter with another vehicle along the road. All radio incidents were documented in detail (Appendix 1), including identification of the truck and driver and the other truck involved (if known). The radio settings for the trucks involved in each incident were subsequently compared to investigate possible causes for the incident.

Road users from two other companies in the Chetwynd area (Talisman Energy Inc. (now Xstrata Coal) and Norm Bunker Contracting) were contacted for interviews and radio checks. Talisman Energy trucks were met at the start of the Sukunka FSR and invited to participate, and Norm Bunker, who is Talisman's primary road maintenance contractor on the Sukunka FSR, was visited at his shop and four vehicles inspected. A limited number of road users from Talisman Energy were contacted because most of the incident complaints had originated from West Fraser operations and from Norm Bunker.

Results

Interview Representation

A total of 49 vehicles are represented in the interview data—86% were owned or contracted by West Fraser, and 14% owned or contracted by Talisman Energy (Table 1). Included with the Talisman data, Norm Bunker was interviewed concerning radio communication problems experienced while in his pick-up or by operators using 3 pieces of road maintenance equipment.

Table 1. Interviews by Vehicle Type and Affiliation

Drivers Interviewed		
Vehicle Type	Talisman Energy	West Fraser
Log hauling truck		39
Pick-up	1	3
Coal hauling truck	3	
Road maintenance	3	
Total	7	42

Of the 49 vehicles stopped for an interview, 39 (79%) were log hauling trucks and 10 (21%) were other types of vehicles (pick-up trucks, coal hauling trucks, and road maintenance equipment). At the West Fraser site, the vehicle drivers were familiar with the RR channels and used them for resource road travel on a daily basis. All, except one driver, had been using the RR channels for at least a year in the South Peace and all had either been aware of, heard of, or had been involved in radio-related incidents. 20 of the 49 drivers interviewed reported that they had been involved in 1 or more radio incidents related to RR Radio Protocol.

Interview responses (complaints)

Interview responses were grouped into five categories:

- 1) communication OK (no complaint)
- 2) no communication
- 3) broken communication
- 4) cut-off calls
- 5) garbled communication

‘No communication’ complaints were the basis for most of the unexpected encounters between vehicles and, thus, are judged to be the most serious type of complaint. ‘No communication’ was also the most prevalent complaint at the West Fraser site. Driver testimonials concerning this communication difficulty were consistent in that these events occurred while vehicles were in sight of one another or in close proximity (<1Km away).

Only 16 of 42 drivers interviewed at the West Fraser site had radio communication complaints in the last year (Table 2). The majority of drivers who reported radio communication problems had incidents of ‘no communication’.

Table 2. Number of drivers by complaint type

# of drivers interviewed by complaint type		
Type of Communication Complaint	Talisman Energy	West Fraser
Communication OK	3	26
No communication		11
Broken communication	3	3
Cut-off calls		2
Garbled communication	1	
Total	7	42

Seven drivers at the West Fraser site reported more than one radio communication problem in the last year while 9 reported only one problem. There were 23 complaints reported at the West Fraser site and only 4 complaints reported by Talisman Energy-affiliated drivers. Thirteen ‘No communication’ complaints were reported – all at the West Fraser site. The number of complaints by affiliation are summarised in Table 3.

Table 3. Number of incidents reported

# of complaints reported by affiliation		
Type of Complaint	Talisman Energy	West Fraser
Communication OK	3	26
No communication		13
Broken communication	3	5
Cut-off calls		5
Garbled communication	1	
Grand Total	7	49

Resolution of Communication Problems

Of the 49 RR Radio Pilot drivers interviewed 27 had radio communication incidents that occurred between Feb. 2011 and Feb. 2012. Detailed accounts of these incidents, with the findings from Industry Canada’s checks of the drivers’ radios, were used to identify systemic radio communication problems and to develop potential resolutions. Of the 27 radio communication incident complaints from between Feb. 2011 and Feb. 2012, 6 had been resolved prior to the field review by the driver and 21 remained

unresolved at the time of the field review. The resolved complaints included broken communications, no communication when on RR channel 21C, and no communication between trucks. Table 4 summarizes the number and type of resolved complaints, their causes and resolutions.

Table 4. Summary of Complaints Resolved Prior to the Investigation

Communications complaint	# of complaints	Cause and resolution of complaint
Broken communication	3	Known bad spot on Sukunka FSR, radio fine in other areas. Driver calls more frequently when traveling through this spot.
No communication when on RR21C channel	2	RR21C was incorrectly programmed in a truck radio that these drivers were trying to communicate with. Problem was resolved by re-programming at the radio shop.
Interviewed driver could hear call from other truck but other truck could not hear him (No communication)	1	Radio which was communicating with him at the time of the incident may have been on the wrong transmit channel or had the wrong tone on his transmit channel. Receive tones were disabled on this driver’s radio when monitor mode was switched on. This driver figured this out on his own but did not report it or know the logic behind why it worked.
Total	6	

A number of complaints received during the interviews had not yet been resolved. These were resolved through the process of the investigation. Table 5 summarizes the number and type of radio communication complaints, their causes and resolutions.

Table 5. Summary of Complaints Resolved By the Investigation

Communications complaint	# of complaints	Resolution of complaint
Broken communication	2	Radio sensitivity set too low caused broken communication and driver was directed to get repairs.
	3	Bad spot on Sukunka unknown to radio user. Driver was advised about bad spot and encouraged to increase call frequency.
No communication	2	These two complaints were caused by the same other truck which had a self-programmed, portable ham radio (unapproved for mobile radio use). Errors in the programming are suspected and the driver was advised to have his radio checked.
	2	Both of these complaints were directed at one truck which had two radios - one of which had an incorrect tone programmed. The driver would choose which radio to use depending on his previous communications with the vehicles he knew were coming. Driver was advised to have his radio programming checked and to use only one radio to avoid them overloading and damaging each other.
	2	These complaints were from one truck which had monitor mode turned off & another truck which had the wrong tone programmed on Tx and Rx. The first truck could not get replies from any radio not operating in monitor mode. This meant the first trucks radio was on the wrong RR channel as his radio checked out OK. The driver was advised to make sure the correct channel is used. The second truck had two radios of which one had correct programming and the other was incorrect. It is suspected that the incorrectly programmed radio was used. The owner was told to use only one radio in his truck for RR channel communication and was advised to remove the faulty radio.
	4	All four complainants' radios had monitor mode turned off and were on the correct RR channel. They could not hear responses from some of the other trucks on the road. (The trucks who these complainants were trying to talk to all had their monitor modes on, so could hear, but could not talk back because they were on the wrong channel).
Cut-off calls	4	Expected to be due to walk-over (exacerbated by being in monitor mode) or incorrect mic keying by other drivers.
	1	Caused by radio sensitivity being too low. The driver was directed to have the radio sensitivity adjusted.
Garbled communication	1	This complaint was about garbled communication. It was found that the radio was malfunctioning and returning a garbled sound to all incoming calls. Driver was directed to repair radio.
Total	21	

Discussion

The radio system on resource roads is used for communication between numerous groups from first nations and the general public to industrial stakeholders and their contractors. Province wide, this amounts to thousands of individuals using the resource road network on a daily basis. The radio system in use for resource roads is not closed loop as it is in a government or in a company where there is tight control of what radio hardware used and how it is programmed.

This investigation has identified there is an abundance of different users converging on resource roads and there is not necessarily a full understanding, by everyone, of all of the features of their radios. Each make and model of radio can behave differently depending on which user controlled settings are adjusted. Toned channels are more vulnerable to user controlled radio settings than non-toned which can give an illusion that the RR channels don't work properly. A mix of these settings between different radios can cause confusion.

With the mix of users on the roads, types of radios in use, different radio configurations, and the number of complaints with no detailed reports, the issues were not easily replicated or validated. FPIinnovations RR channel testing in 2009 and 2010 did not show any problems with the channels.

Several kinds of problems were identified and resolved during the investigation at Chetwynd. These included issues associated with use of the radio's monitor mode, issues created by insufficient reception sensitivity, and other radio issues. The following discusses these issues and how they were resolved.

Monitor mode. At West Fraser, reports of no communication, broken communication, cut-off calls, and garbled communication were the complaints heard. 48% of them were for 'no communication'. It was found that 74% (Industry Canada Resource Road Report – March 2012) of radios in the vehicles that were questioned had monitor mode activated and 26% did not. The monitor mode setting can be activated or deactivated in a few ways depending on make and model of radio:

- manually on or off by pushing a button on the front of the radio
- passively by grounding the microphone to the chassis of the radio (this can be programmed to operate inversely as well depending on who set up the radio)
- programmed by the radio shop to be on or off when certain channels are selected.

When activated, monitor mode allows the radio to receive a frequency regardless of the tone programmed to that frequency (in the internal radio programming done at the radio shop). Transmit is not affected. In the case of the RR channels, for example, RR15 A, B and C all share the same frequency but have different tones. A radio with monitor mode activated will receive all three. This only becomes a **local** problem if one radio is inadvertently on the wrong channel. It becomes a walkover problem if the RR channels are not geographically buffered far enough apart; radios in monitor mode hear distant RR channels of the same frequency.

Examples (assuming radios are programmed correctly):

- 1) If Vehicle A¹ is in monitor mode and is on RR15B, the correct road channel in this case, it can hear transmissions from other radios also on RR15A and RR15C. If Vehicle B also is in monitor mode and is on RR15C, it will hear Vehicle A and will transmit to Vehicle A on channel RR15C. **Vehicle A will still hear it because its radio is set to monitor mode.** In this case, everybody hears one another even though one of the radios is off by one channel.
- 2) If Vehicle A is **not** in monitor mode and is on RR15B, it will only hear transmits from RR15B. If Vehicle B **is** in monitor mode, and is on RR15C, it can still hear Vehicle A. In this case, Vehicle A will not hear a reply from Vehicle B.
- 3) If Vehicle A is **not** in monitor mode and is on RR15B, it will only hear transmissions from radios on RR15B. If Vehicle B is **not** in monitor mode and is on RR15C, neither vehicle will hear one another. This scenario is like having two separate channels (i.e., how the RR channels were intended to work).

A few road users at West Fraser complained of no communication, even though they could see one another. Again, it was found through the investigation process that 74% of radios were set to monitor and 26% of others were not. A mix of these settings caused confusion because some trucks were not on the correct channel some of the time. Derek Dyck of West Fraser noted that he had difficulty receiving calls some of the time. None of West Fraser's pick-up radios had monitor mode activated. The Rx (reception) light would turn on when others called to Derek – even if he could not hear them. Derek's Vertex Standard 2100 radio turns on the Rx light if it detects a correct frequency regardless of tone, which meant the call from the other truck was being transmitted on the wrong RR channel. This was a key piece of evidence to the investigation. Industry Canada technicians confirmed this radio behaviour could **only** result if this was the case. Derek testified to the investigators this was happening on a regular basis and that other trucks on the road (who unknowingly had monitor mode on) could hear the trucks that Derek couldn't. This caused great confusion and a loss of confidence in the RR channels among the users.

There was also a visual trend among vehicles which showed that the drivers which had the most complaints (as well as complaints against them) were the most likely to have untidy cabs and had radios which were not ergonomically mounted with a good clear view of the electronic channel display. Also, the majority of the vehicles checked had TADM10 radios (Industry Canada, Resource Road Report – March 2012). TADM10 radios are unique in that they have sensitive channel up/down buttons on the top of the handheld microphone. This button arrangement can exacerbate the chance of a user inadvertently selecting a different RR channel by one push of the up/down buttons in either direction. On a resource road which uses a "B" channel, under the right circumstances, there is a risk of a communication problem because of being on the wrong channel. The Moberly Lake FSR, a main haul road in West Fraser's operating area uses RR15B.

¹ Vehicle A and Vehicle B are within radio communication of one another

Receive sensitivity. Several radios in the West Fraser woodlands vehicle fleet were measured for receive (reception) sensitivity because of the types of complaints the users expressed. All three were set on the low end of the sensitivity scale with one lower than the other two. All three users complained of broken communications which they thought were worse than pre-pilot for their operating area. The sensitivity findings from Industry Canada, Resource Road Report – March 2012 read.....*“the receive threshold of three West Fraser pick-ups that had Vertex Standard radios was measured, one was at -92dBm and the other two were at -98dBm. The -92dBm operator did complain of broken communications as this level should be around -100dBm to -115dBm depending on the noise floor. These radios did not have user squelch control to be able to adjust the squelch above the noise floor (i.e., adjust until you don’t hear constant static). This is significant because radios set to a higher receive threshold of -92dBm will require a high signal level before the radio will respond”*. In areas which naturally have limited reception because of geographical constraints, these radios will not receive well and could give the impression something else is wrong.

Other radio problems. Further to the issues discovered at the West Fraser site, FPInnovations and Industry Canada visited Norm Bunker Contracting, a Talisman Energy contractor who is responsible for road maintenance on the Sukunka FSR. Mr. Bunker had similar concerns and complaints with reduced radio performance since adopting the RR channels. A check of his radio hardware installed in his road maintenance equipment and vehicles, by Industry Canada, revealed his own TADM10 mobile truck radio was inoperative when receiving signals from other radios. When it was set to one RR channel, it could receive any RR channel transmitted from a test portable (receive quality was scratchy and broken). Some of the road maintenance equipment used cigarette-style power connectors and magnetic mount antennas for ease of moving radios between units. Cigarette-style power connectors are known to loosen and cause power interruptions to the radio equipment. If the wire size is too small, the required 6A power draw cannot be delivered during a transmit function which will reduce the overall transmit power of the radio. The wires to magnetic mount antennas used for temporary radio installations are typically routed through window or door frames, and it is there that they can be kinked or the wire’s sheath damaged. Even wires with no visible sheath damage may have internal damage caused when the wire was pinched when the window or door was closed. Damaged or kinked antenna wires will compromise the performance of the radio.

Conclusions

The RR channels currently being piloted by the MFLNRO in the South Peace are part of a larger initiative to improve road safety. Road users at West Fraser Mills, Chetwynd and other industry stakeholders complained of radio performance issues since the pilot was initiated. Some issues were thought to have been resolved after a short investigation in 2011 about cut-off calls. The other types of complaints were too variable and detailed records were not available about them.

FPInnovations interviewed 49 vehicles and fielded 27 complaints about radio incidents between three sites. 86% of the vehicle drivers interviewed were log haulers and woodlands staff from West Fraser Mills. The remainder were coal truck drivers and a road maintenance contractor who worked for Talisman Energy. Industry Canada performed radio checks on the same vehicles, where possible and advised on problems and gave advice where required.

Radio incidents were categorized as “broken communication”, “no communication”, “cut-off calls”, and “garbled communication”. 48% of the complaints were for incidents of “no communication” which FPInnovations deemed as the most serious. If no communication could be made, there is no indication that a vehicle is in the vicinity.

It was found through interviews with drivers and checks of their radio hardware, that most could activate monitor mode at any time (rather than requiring programming changes at a radio shop). Activation of monitor mode made their radios behave in a manner that was not fully understood. Monitor mode changes the way a users’ radio interacts with others but only on channels where tones are used. To remove the chance of monitor mode affecting radio function either the tones need to be removed from the RR channels or road users must not operate with monitor mode activated. Because there are many types of road users on Pilot roads, and some require the activation of monitor mode, it is likely not feasible to eliminate the use of monitor mode by Pilot road users.

Programming issues, such as setting the squelch at too high a level, was also found to contribute to poor communications (Industry Canada Resource Road Report – March 2012) as did poor installation and maintenance of radio equipment in some vehicles.

Recommendations

- A process should be developed to ensure that incidents are recorded and reported in a timely manner with the appropriate details.
- Radio checks should be performed by individual users without fail before entering a resource road and radio use procedures should be followed.
- The tones should be removed from the RR channel specification. This will eliminate the chance of monitor mode negatively affecting radio communications and still allow road users to utilize monitor mode where required.
- Education is needed for road users to help with understanding the functions of their radios.
- A best practice document should be produced as a guide for proper radio installation and maintenance.

APPENDIX 1. Investigation Questionnaire

FPInnovations Radio Incident Investigation

Today's Date: _____

Time: _____

Driver information:

Name _____

Truck ID _____

Company _____

Contact phone # _____

Email _____

Best time to call _____

1) Have you had any incidents that were communication related within the last year?

a. Yes

i. How many? _____

b. No

c. No, but I'm aware of others and they were:

1. Name _____

2. Truck type _____

3. Which contractor _____

2) When and where did the incident happen?

a. Date & time _____

f. Weather _____

b. Road Name _____

g. Terrain _____

c. Channel used _____

d. Km mark _____

e. Direction _____

3) What kind of radio incident was this?

a. No communication at all _____

e. Other _____

b. Broken communication _____

c. Walkover _____

d. Cut-off call _____

4) Were you in this vehicle when all the incidents happened?

a) Yes

a. What radio were you using (make and model) _____

b. Who did the programming of the channels? _____

c. When was the last maintenance done on the radio system? _____

b) No (fill out above info as best as can be remembered)

5) What type of vehicle were you communicating with or expecting communication from?

a) Pick-up

a. A West Fraser pick-up?

i. Which one _____

b. Government pick-up?

i. Details if available _____

c. Another pick-up?

i. Details if available _____

b) Log truck

a. Truck from your own contractor's fleet?

i. Which one (ID) _____

ii. Driver name _____

b. Truck from a different contractor?

i. Colour of log truck _____

ii. Have you had any complaints about this truck before? _____

6) What was the proximity of the vehicles to on another (how far apart were you)?

7) Were you calling your position and direction of travel or were you making general communication when the incident happened? _____

8) Do you have any idea what might have caused the communications problem? _____
