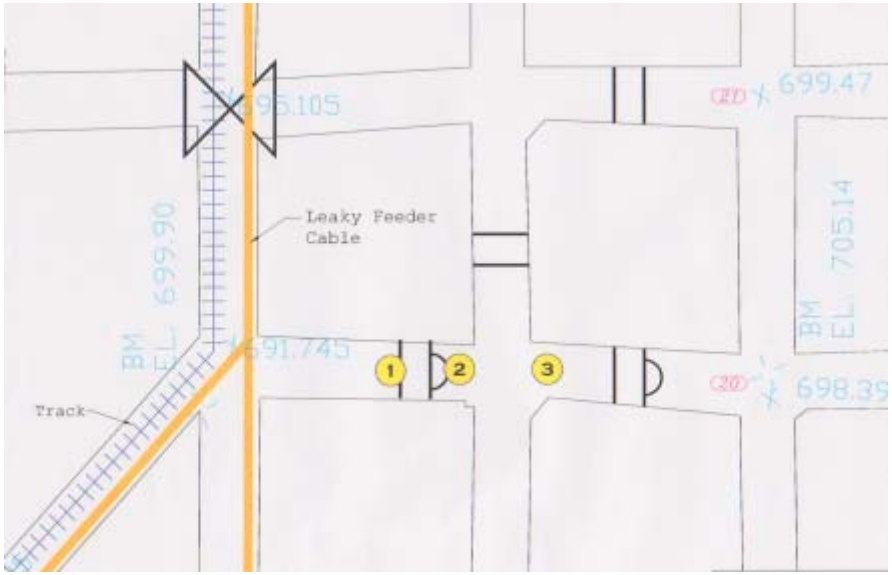
Miner to Reader Test Data Marco VisorTrac

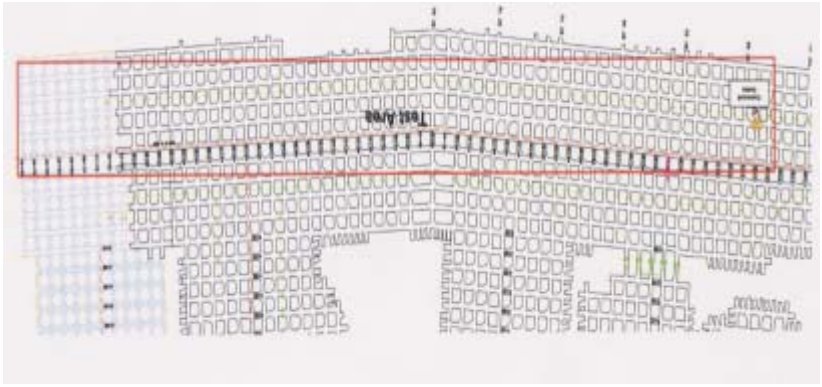
Equipment	Test Site	Comm Type	Number of Miners	Distance to Reader or Coverage Area	Rate of Travel	Describe Ride	Entry/Crosscut Conditions			
							Height	Width	Scenario	Notes
VisorTrac	MAR-011807-A	900 mhz ISM	1	700 ft	5mph	Battery Mantrip	72”	20’	1,3,6- block wall	Level with slight rolls See Imperial map
VisorTrac	MAR-050907-B	900 mhz ISM	10 Tags	700 ft	5 mph	Battery Mantrip	84”	20’	1,7 block wall	Tracking signal passed through dip of 10 degrees see River Edge Map
VisorTrac	MAR-111706-C	900 mhz ISM	12 Tags	900 ft	25 mph	Diesel pickup truck	124”	20’	2	Tags were in enclosed truck – see report Dugout Mine

Equipment System/Miner	Test Site	Comm Type	Distance from Backbone or Node	Entry/Crosscut Conditions				SIO Score	Distance from Surface Comm-Center	Number Amps/Nodes to Surface Comm-Center
				Height inches	Width feet	Scenario	Notes			
N/A for VisorTrac										

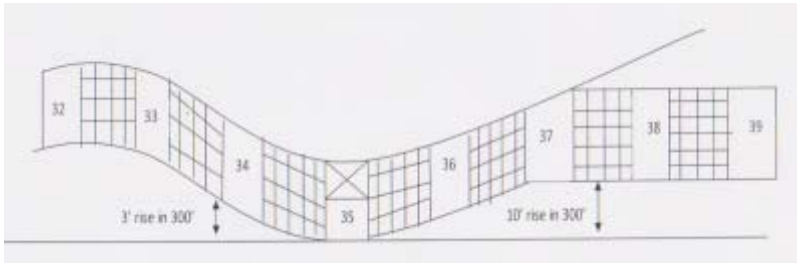
Top View



Relative Mine Location



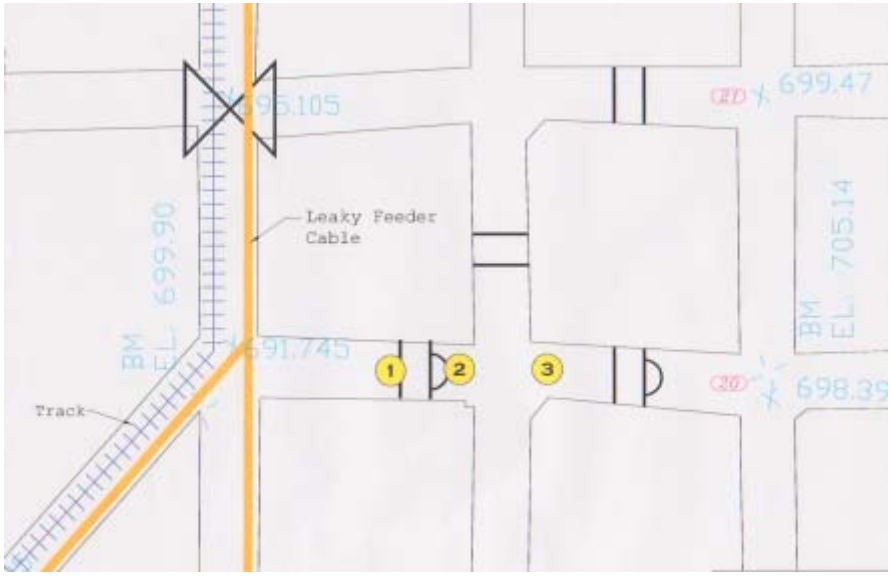
Side Elevation



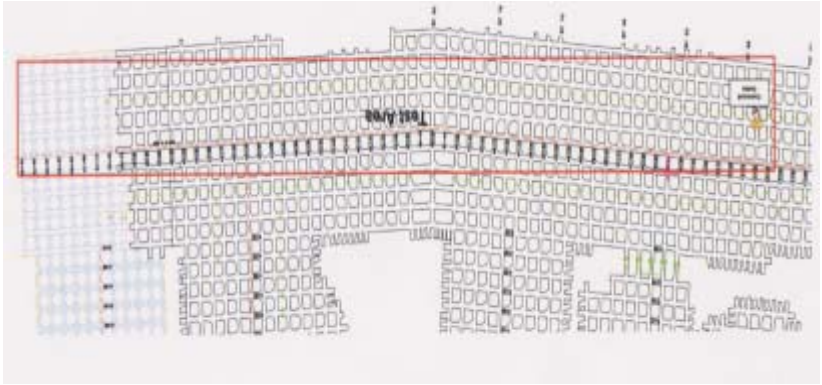
Name of Mine	Date of Testing	Certifying Engineer

Equipment	Test Site	Comm Type	Distance Between Miners	Entry/Crosscut Conditions				SIO Score
				Height	Width	Scenario	Notes	
N/A for VisorTrac								

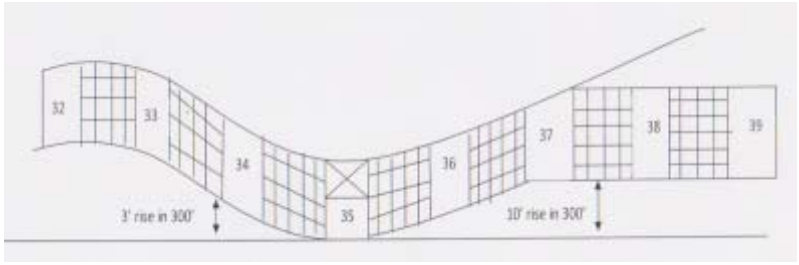
Top View



Relative Mine Location



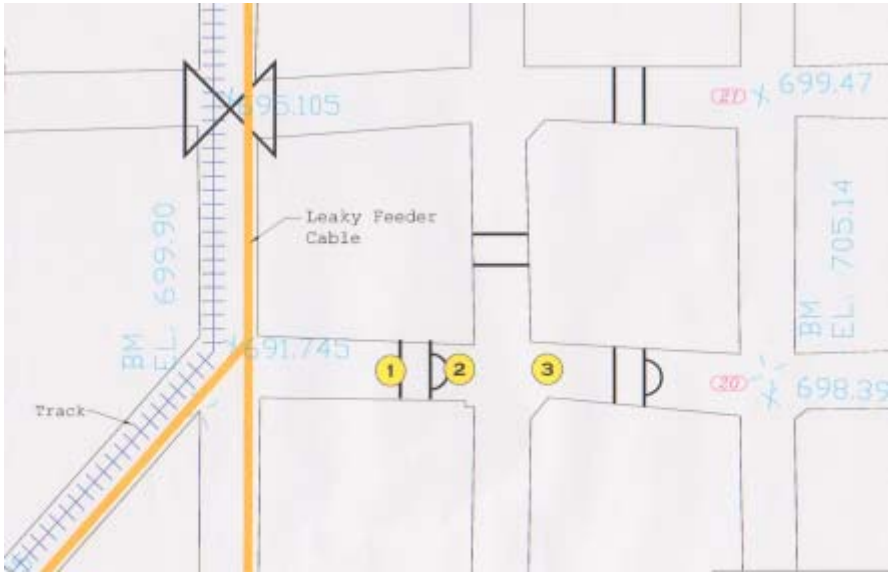
Side Elevation



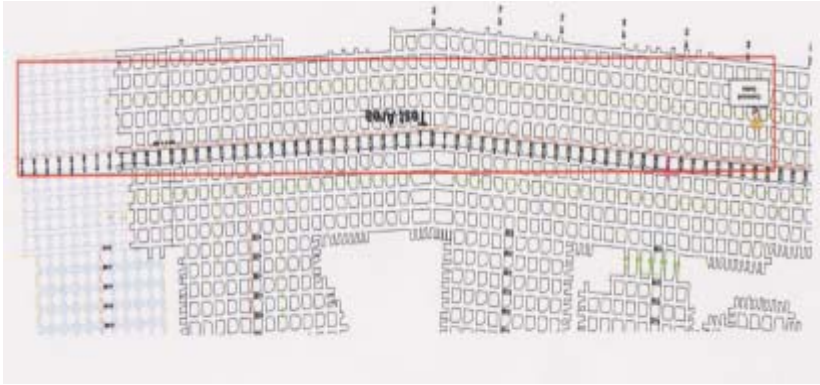
Name of Mine	Date of Testing	Certifying Engineer

Equipment System/Miner	Test Site	Comm Type	Distance Reader to Surface Comm-Center	Entry/Crosscut Conditions				Number Amps/Nodes to Surface Comm- Center
				Height inches	Width feet	Scenario	Notes	
VisorTrac Marco	MAR-050907-B	Leaky Feeder	800 ft	84”	20’	1,7 block wall	See Rivers Edge map	1

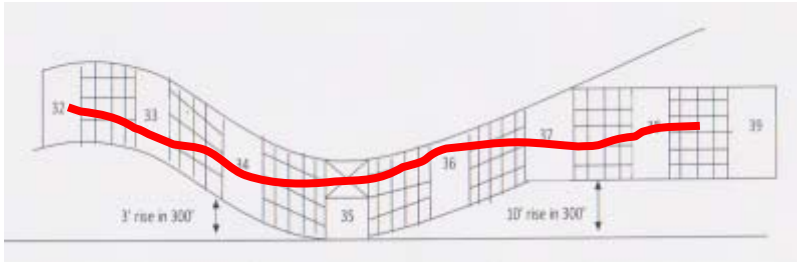
Top View



Relative Mine Location



Side Elevation



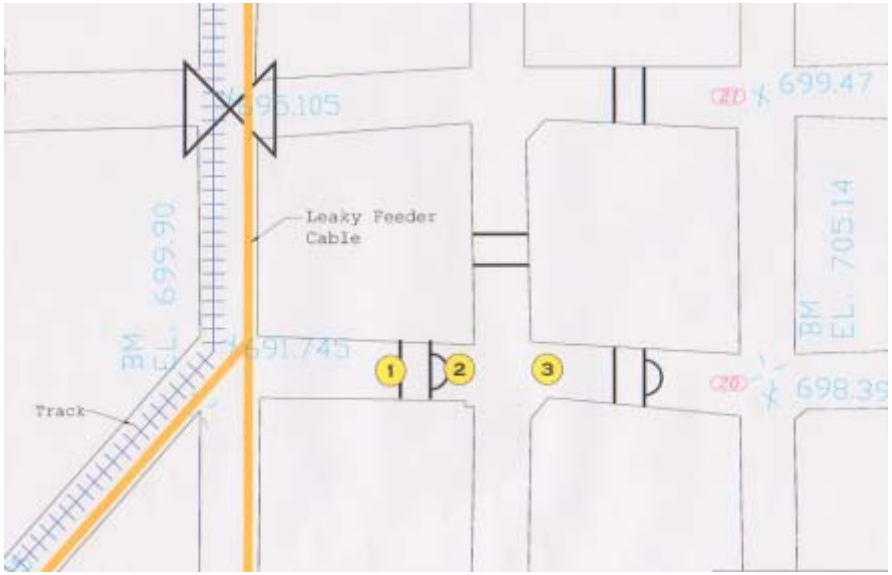
Name of Mine	Date of Testing	Certifying Engineer
Rivers Edge Mine	05-09-2007	

Reader to Surface Test Data Marco VisorTrac

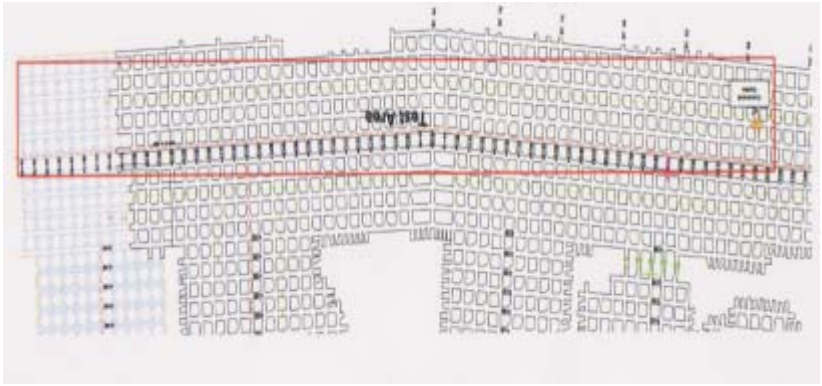
Equipment System/Miner	Test Site	Comm Type	Distance Reader to Surface Comm-Center	Entry/Crosscut Conditions				Number Amps/Nodes to Surface Comm- Center
				Height inches	Width feet	Scenario	Notes	
VisorTrac RCU, RINC & PRIM PTT-1	MAR-011807-A	Leaky Feeder	1400 ft	72”	20’	1,3,6-block wall	See Imperial map	1
VisorTrac RINC & PRIM PTT-1	MAR-050907-B	Leaky Feeder	800 ft	84”	20’	1,7 block wall	See Rivers Edge Map	1
VisorTrac RINC & PRIM PTT-1	Mar-111706-C	Ethernet	5000 ft	124”	20’	2	See report Dugout Mine	2

Equipment	Test Site	Comm Type	Number of Miners	Distance to Reader or Coverage Area	Rate of Travel	Describe Ride	Entry/Crosscut Conditions			
							Height	Width	Scenario	Notes
VisorTrac	MAR-011807-A	900 mhz ISM	1	700 ft	5mph	Battery Mantrip	72”	20’	1,3,6 block wall	See Imperial Map

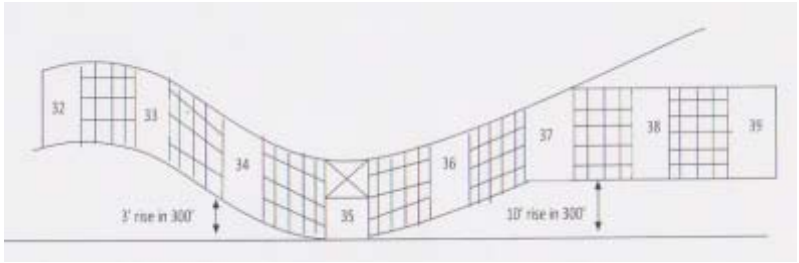
Top View



Relative Mine Location



Side Elevation



Name of Mine	Date of Testing	Certifying Engineer
ICG Imperial Mine	1/18/2007	John Rinehart, P.E. WV #5014

Survivability/Re-Establish Marco VisorTrac

Element(s)	Dynamic Impact	Fire	Static Pressure	Power Interruption
<Name/Description>	<Likely failure>	<Likely failure>	<Likely failure>	<Likely failure>
	<Re-establish options>	<Re-establish options>	<Re-establish options>	<Re-establish options>
Radio Control Unit RCU	RCU in X/P box, directly in path will fail most likely due to cable breakage	Fire will destroy the cables and/or readers. The X/P box may not survive?	The X/P box may survive, but cables and readers may not.	The RCU has battery backup to keep the unit powered for more than 12 hours.
	If the unit can still respond to polling over the leaky feeder then splicing or replacing the cable or readers. Spares should be available	If the unit can still respond to polling over the leaky feeder then splicing or replacing the cable or readers. Spares should be available	If the unit can still respond to polling over the leaky feeder then splicing or replacing the cable or readers. Spares should be available	The internal battery will still power the readers and pass the tracking data to the leaky feeder
RINC Reader ISC Unit	Directly in path will fail most likely due to cable breakage and housing breakage	Directly in path will fail most likely due to cable and housing melting	Directly in path will fail most likely due to cable and housing breakage	The RCU has battery backup to keep the unit RINC readers powered for more than 12 hours.
	Replace the unit and associated cable. VisorTrac uses quick connect cables for this purpose. Spares should be available	Replace the unit and associated cable. VisorTrac uses quick connect cables for this purpose. Spares should be available	Replace the unit and associated cable. VisorTrac uses quick connect cables for this purpose. Spares should be available	The internal battery will still power the readers and pass the tracking data to the leaky feeder
RINC Reader X/P Version	Directly in path will fail most likely due to cable breakage	Fire will destroy the cables and/or readers. The X/P box may survive?	The X/P box may survive, but cables and readers may not.	The RCU has battery backup to keep the unit RINC readers powered for more than 12 hours.
	If the unit can still respond to polling over the leaky feeder then splicing or replacing the cable or readers. Spares should be available	f the unit can still respond to polling over the leaky feeder then splicing or replacing the cable or readers. Spares should be available	If the unit can still respond to polling over the leaky feeder then splicing or replacing the cable or readers. Spares should be available	The internal battery will still power the readers and pass the tracking data to the leaky feeder
PRIM PTT-1 Tag is worn is attached to the miners belt with rivets.				
VisorTrac cables	Will be destroyed	Will be destroyed	Will be destroyed	

	VisorTrac cables are fitted with a field mountable connector easily installed underground. They are available in various lengths ready for deployment.	VisorTrac cables are fitted with a field mountable connector easily installed underground. They are available in various lengths ready for deployment.	VisorTrac cables are fitted with a field mountable connector easily installed underground. They are available in various lengths ready for deployment.	

Legend

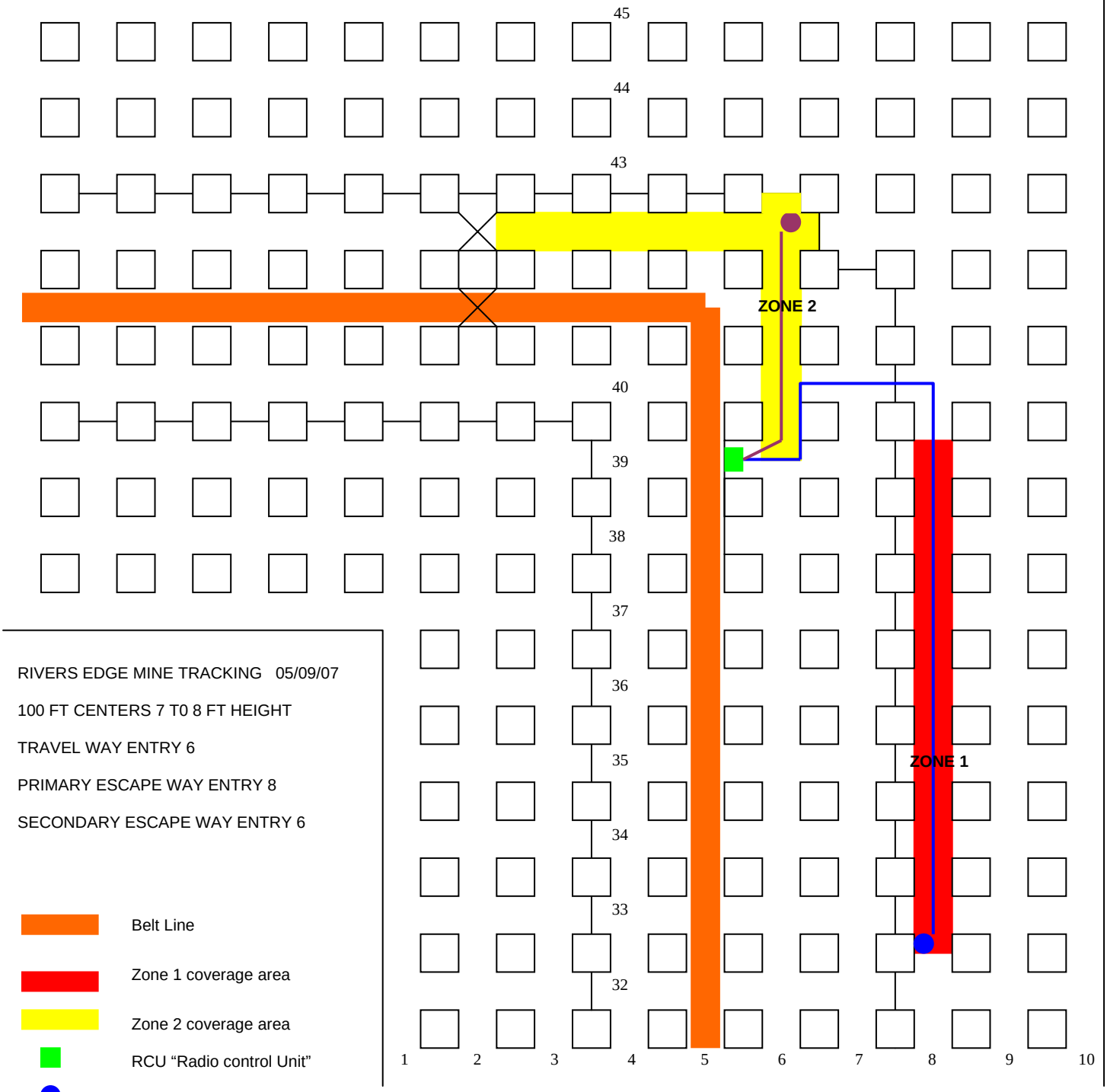
- **Element** – provide the name and description of each element of the product/system
- **Dynamic Impact** – in the top cell describe what is likely to happen if the Element is in the path of explosion moving down an entry and in the lower cell describe what options there are for re-establishing the system in the case the element is rendered non-functional and what testing was done to verify performance
- **Fire** – in the top cell describe what is likely to happen if the Element is subjected to a fire and in the lower cell describe what options there are for re-establishing the system in the case the element is rendered non-functional and what testing was done to verify performance
- **Static Pressure** – the top cell describe what is likely to happen if the Element is subject to a static pressure as the result of an explosion and in the lower cell describe what options there are for re-establishing the system in the case the element is rendered non-functional and what testing was done to verify performance
- **Power Interruption** – in the top cell describe what is likely to happen if power to the Element is interrupted and in the lower cell describe what options there are for re-establishing the system in the case the element is rendered non-functional and what testing was done to verify performance

Process Notes:

For purposes of comparison, manufacturers should reference the Sago Reports on the WV OMHS&T web page. The reference scenario is that event.

It is difficult to predict specific impacts on each technology because of the variety means of placing specific elements of the communication-tracking systems within the entry or cross section. Generally most likely worst case event is an explosion which will destroy all devices protruding from the rib, roof or floor for a distance of 2000 feet. The second most likely worst case event is a fire or extreme heat that has propagated though out an area of 500 feet of entry or cross cut and has destroyed all man-made devices protruding from the rib, roof or floor. Manufacture may assume their devices will survive these events if they have demonstrated

MAR-050907-B Rivers Edge Mine



RIVERS EDGE MINE TRACKING 05/09/07

100 FT CENTERS 7 T0 8 FT HEIGHT

TRAVEL WAY ENTRY 6

PRIMARY ESCAPE WAY ENTRY 8

SECONDARY ESCAPE WAY ENTRY 6

- Belt Line
- Zone 1 coverage area
- Zone 2 coverage area
- RCU “Radio control Unit”
- Zone 1 RINC “reader”
- Zone 2 RINC “reader”
- Zone 1 RS485 cable
- Zone 2 RS485 cable

This test was performed with 10 tags “PRIM’s”, 2 readers ‘RINC’s” and 1 radio control unit “RCU”
.
The RCU transmitted the RINC data over the UHF leaky feeder.

Zone 1 – Subjects walked No. 8 entry with the PRIM’s as plotted in RED.

Zone 2 – Vehicle traveled No. 6 entry with the PRIM’s as plotted in YELLOW. (speed approx. 5 mph).

marco North America, Inc. VisorTrac RFID Tracking Systems

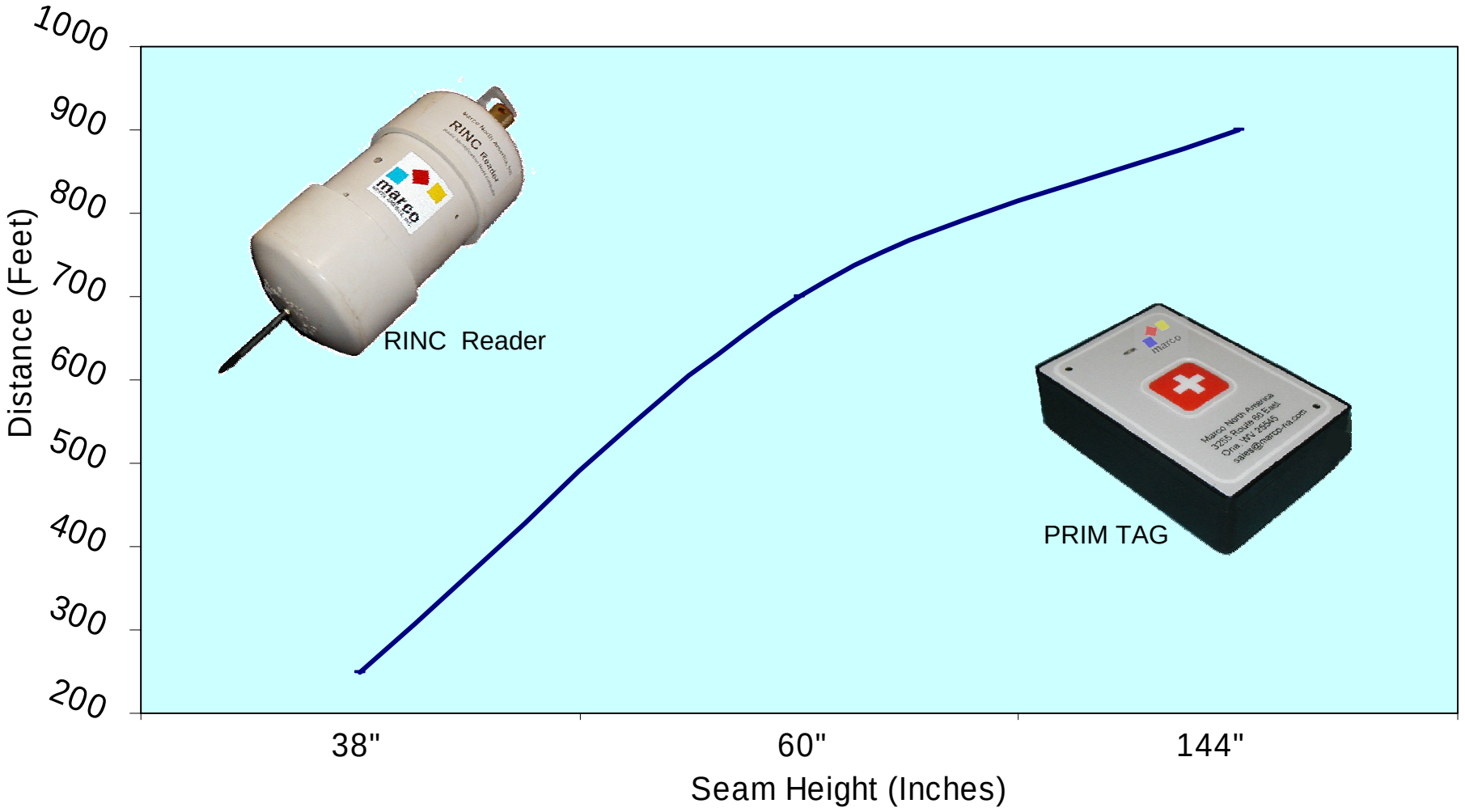
marco
North America, Inc.

MARCO TRACKING TAG “PTT-1” RANGE CHART

VisorTrac
RFID Tracking Systems

Testing Data from 5 different underground mines

Typical PRIM Transmission Range



MAR-111706-C Dugout Mine

Marco North America

Date Created: 11/20/2006 12:10 PM
Last Edited: 11/20/2006

Mine Visit Report:

Visit by: R. Murray on 11/17/06

Reason for Visit:

Look into problems with tracking
System not picking up all 12 tags

Details:

Mine Visit to Dugout mine near Price UT. Meet with Pat Lemmon about problems with tracking system. It was reported to us that Pat had trouble receiving all 12 PRIMs on a unit underground. We had looked into a number of issues at the office including firmware as well as proximity of units to each other as causing problems such as described. We felt that it could be proximity of units causing him to miss a few of the tags as they where tested in one box in the cab of the truck.

I met with Pat a little before 8am their time and we talked a little about the problem and some of our ideas of where the problem could be as well as problems we have solved after looking into the issues. I also checked out the configuration of the B&B boxes and found that the port numbers where off from where Pat had changed the units from UDP to TCP at our request. Once we changed to port numbers to mach and restarted the units the two B&B converters made connection and worked correctly.

Pat had located the two RINC units in two different areas of the mine. One was located in a longer straight area of the mine with little or no other devices or wires to cause interference with the system. The second unit was near a power center and was surrounded with high voltage cables and other wires, the power center it self was located behind a metal stopping. From my vantage it seems the mine had wire mesh over the roof in all entries. The two units where mounted so the side of the body hung close to the wire mesh to keep the antenna out of the way and to prevent them from being broken.

We talked about the antenna and I told him we would send him some antennas on pigtails so he could hang the antenna straight down supported by the coax and it should give him better performance as well as prevent damage to the antenna. Long term I think we need to make the standard model with the antenna internal to prevent damage.

We made a few passes by the RINC units and found zone 2 seemed to not receive all tags as it should, even though zone 1 unit looked ok. We tried letting the zone 2 unit hang down and tried again and still had a problems getting all 12 tags. At this point I took a closer look at the unit and noticed that the antenna was lose as well as was bent at odd angles to a normal antenna. I replaced this antenna and we tried the drive by tested again. Zone 1 unit preformed well picking up all 12 tags as well as Zone 2 received all 12 tags as quickly as expected.

After the trip I tested the antenna removed from the mine and it was indeed damaged and was not functional at all. The fact we where able to hear 9 out of the 12 tags at all was really very good with this damaged antenna. Below are readouts of the two antennas One being a good antenna and one the bad antenna removed from Dugout.

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MAR-011807-A IMPERIAL MINE

The VISORTRAC system consists of these basic components:

- RFID encoded UHF transmitter to identify personnel. Unit is attached to the miner's belt and is known as a **PRIM** "**P**ortable **R**adio **I**dentification **M**odule". It is MSHA certified as intrinsically safe.
- A UHF transceiver and embedded controller used to collect data from **PRIM**'. Units are placed at strategic points in the mine where personnel travel or work and are known as **RINC "R**adio **I**dentification **N**ode **C**ontroller".
- Computer PC with SQL Software and tracking application software known as **VISORTRAC.**

Visortrac System Operation

All personnel entering the mine are required to have a PRIM. The PRIM is powered by an internal battery with a lifetime of up to 2 years and transmits a unique identification code every two (2) seconds. It has a transmission range greater that 200 feet in most mine entries.

The signals of the PRIM are received by RINC's. The RINC unit is connected to the existing communications backbone in locations where monitoring of personnel are desired. RINC's can be delivered with an interface to Ethernet, RS-485 multi-drop cables and links to leaky-feeder radio are also possible. When a person wearing a PRIM is within range of a RINC the data packet transmitted by the PRIM is combined with other data such as real time clock from the RINC and is passed to the VISORTRAC PC located in the mine office. The packet contains information on status of the battery, alarm button, signal strength and the exact time the PRIM was at that location. All RINC's have real time clocks that are synchronized once each day by the VISORTRAC Server. See Exhibit 6 for screen shots of VISORTRAC Software.

PRIM (TAG) The Marco PRIM is attached to the miner's belt. The unit is small in size and light weight approximately 2 x 3 x .75 inch. Construction is ABS plastic, potted and fitted in leather pouch riveted to the belt. The pouch has a small hole for pressing the man-down button. The unit is not repairable. MSHA Certified under CFR Part 23 as intrinsically safe.
MSHA NO. 23-A060001-0 **See exhibit for picture of PRIM**

VISORTRAC Radio-RINC (**Reader)** The Marco RINC collects and passes the tracking data to a Leaky Feeder system. The data is coupled off the feeder at the head-end unit and passed to the VISORTRAC software. It is not necessary to attach any components to any portion of the underground Leaky Feeder system. This method uses radio modems with data speed of approximately 19.2 kbaud. **See exhibit for a picture of RINC**

VISORTRAC RINC (Reader) The Marco standard RINC collects tag data; time stamps it and passes the data to the VISORTRAC software in the mine office. The RINC may be connected to various combinations of data transfer such as EIA-485, Ethernet or any medium with sufficient bandwidth.

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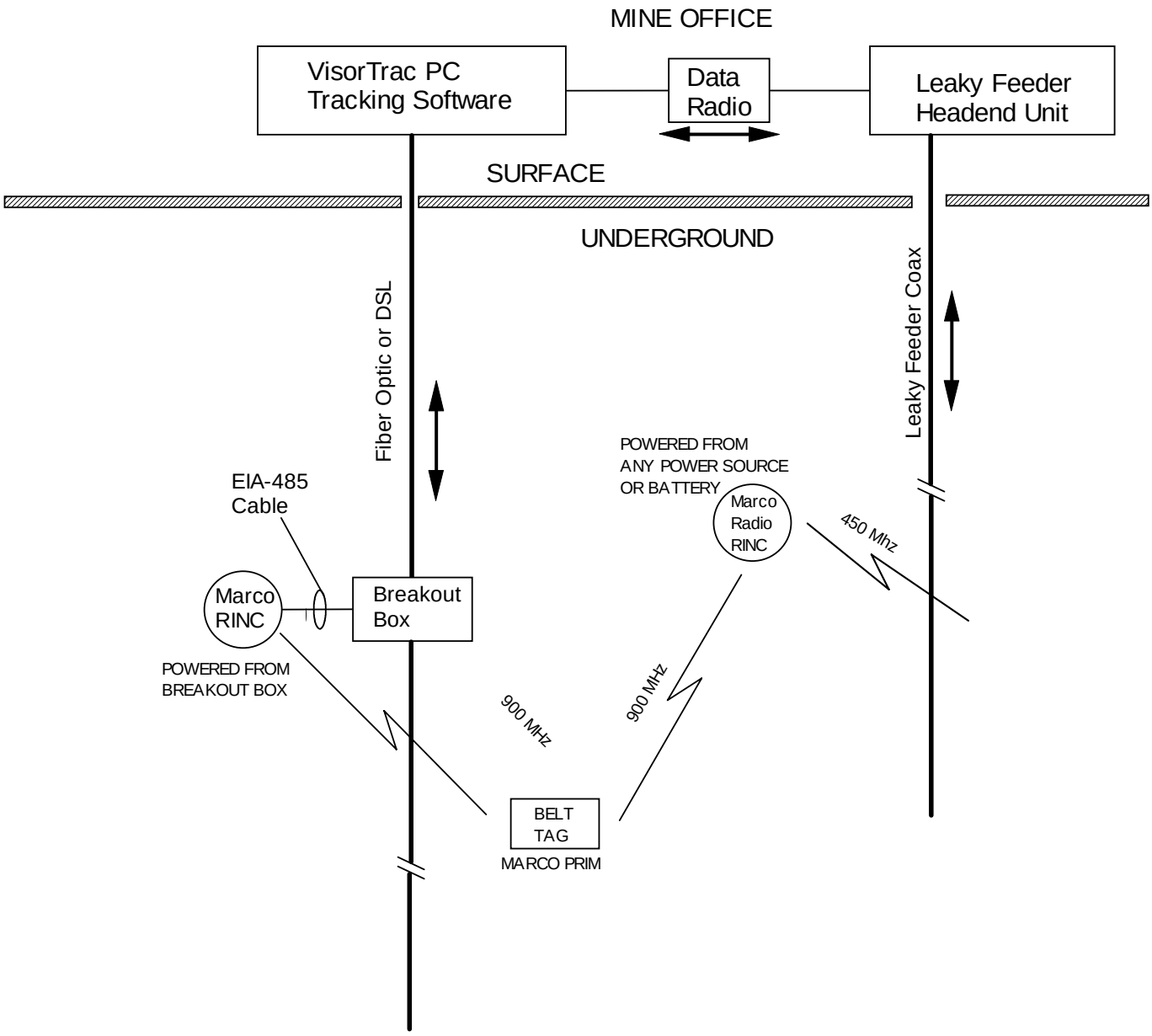
One Connection Diagram of the VISORTRAC System



This test performed at Imperial Mine used only the Radio RINC for reading the tags. The idea is that the medium for transfer of the tracking information can be whatever medium that is available.

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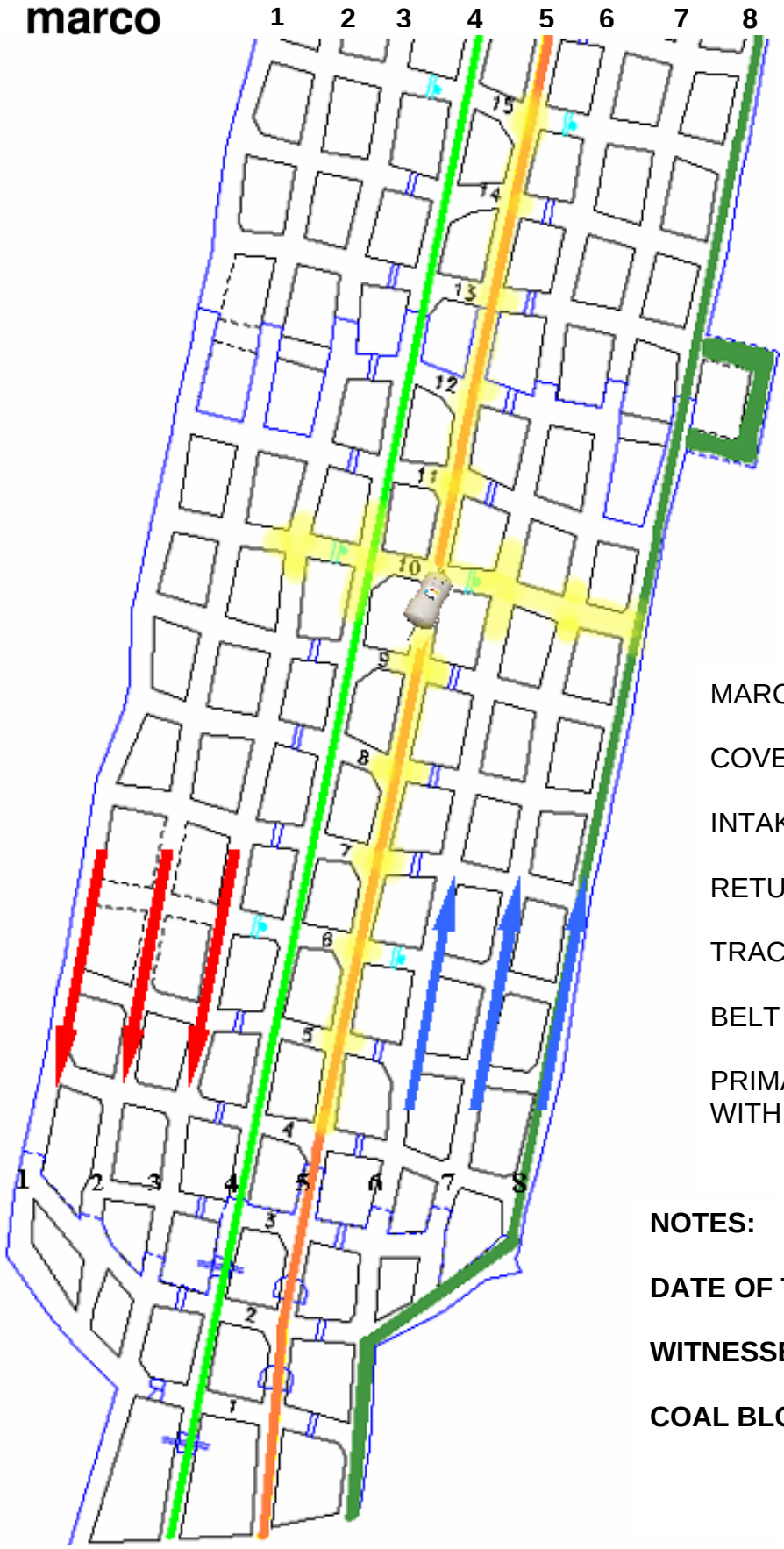

MARCO READER

COVERAGE WITH TAG

INTAKE AIRWAY

RETURN AIRWAY

TRACK ENTRY

BELT ENTRY

PRIMARY ESCAPE WAY
WITH LIFE LINE

NOTES:

DATE OF TEST WAS 01-18-07

WITNESSED BY: JOHN RINEHART, P.E.

COAL BLOCKS ON 70 FT CENTERS

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E-mail: sales@marco-na.com

On January 18, 2006 the following people witnessed the test at ICG Imperial Mine located at Buckhannon, WV.

Underground Witness
John Rinehart P.E. State of WV
Prof. Roy Nutter, WVU
Stuart Anderson, Hughes Supply
Musat Crihalmeanu, Hughes Supply

Surface Witness
Larry Murray, Marco
Robert Murray, Marco
Tom Hughes, Hughes Supply
Bruce Payne, Imperial Mine
Barry Elliott, Imperial Mine

Please Reference the Imperial Mine Map to see the coverage areas.

The Visortrac Software running on a PC in the office. The PC was connected to the leaky feeder through a data radio with connection to the RF board in the leaky feeder head-end unit.

A Marco radio RINC was installed within radio range of the leaky feeder. No electrical connection to the leaky feeder. The Marco RINC required 12 VDC and was powered from the local power center via a power cord.

The detection range of the Marco PRIM TAG was monitored in the mine office by watching the software. Communications with the underground witness was maintained by UHF radio on the leaky feeder.

Test confirmed with the RINC reader in the number 5 travel way, we were able to read the PRIM Tag into the primary escape-way number 8 entry. This was through a cement stopping with a metal man door.

Test to the other side of entry 5 into return entry 3 was confirmed across the belt structure and through a cement stopping with metal man door..

Test in the travel way number 5 confirmed tracking signal out-by to number 4 block and in-by up to number 15 block.

PRIM Distance In 6 Ft Height
ANR Mine in Virginia