

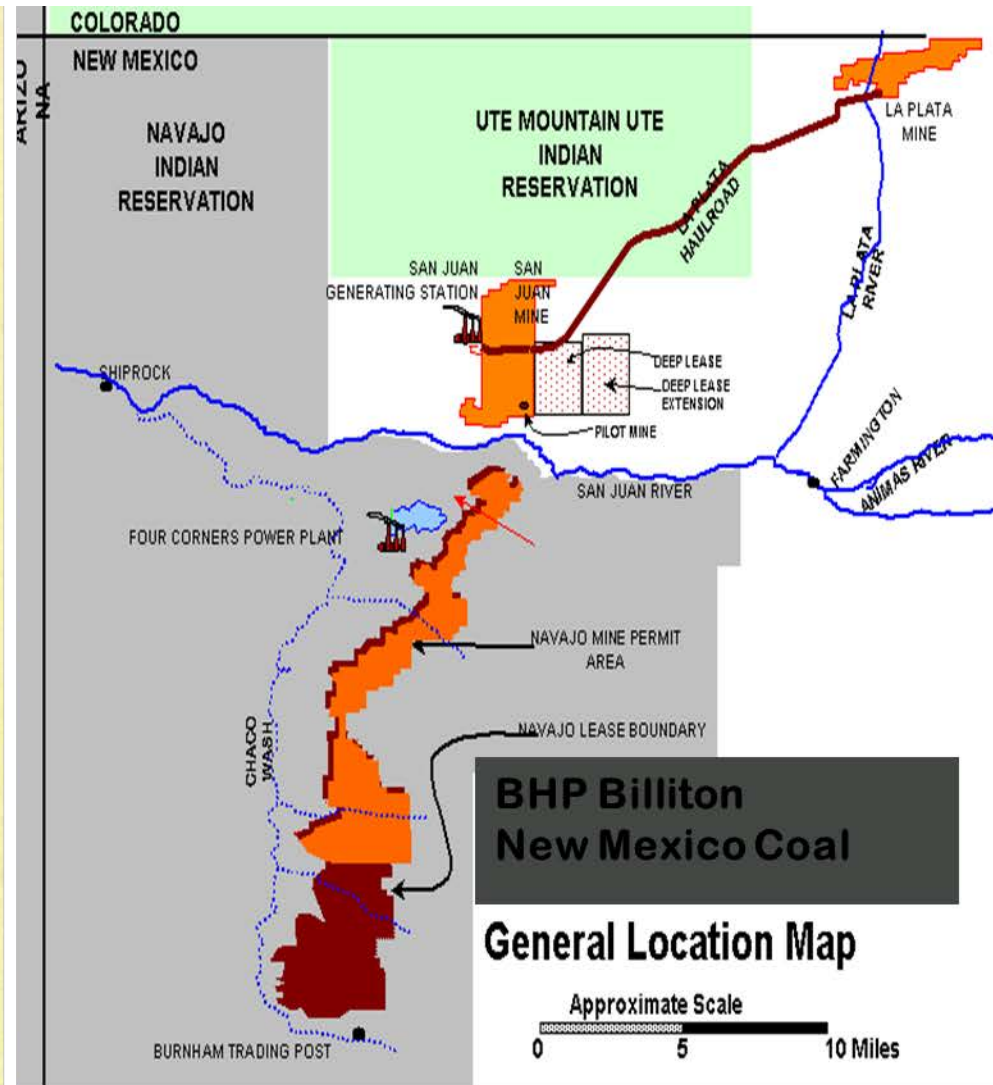
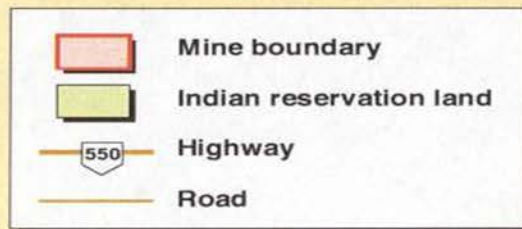
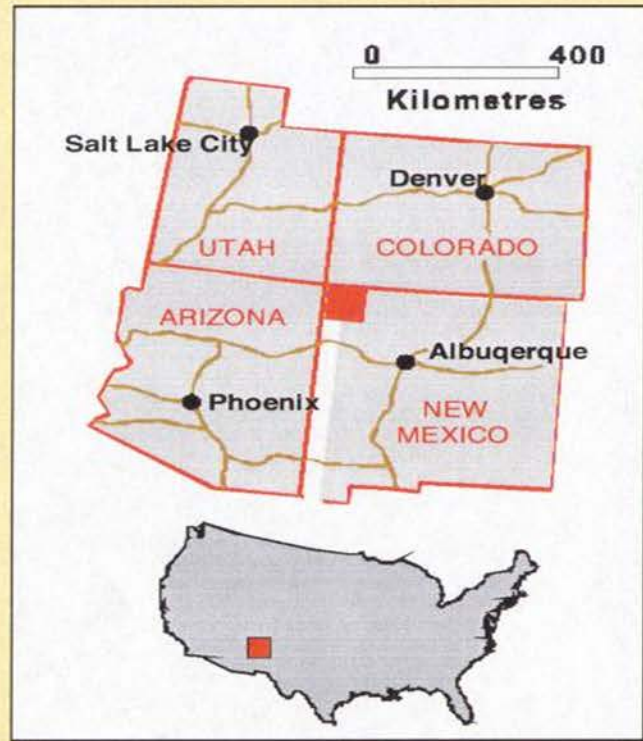


Built-In-Place Refuge Alternatives – (BIP-RA) San Juan Coal Company

David Hales
Health & Safety Manager
February 10, 2015



New Mexico Coal



BIP RA History at San Juan Mine

- First installation, March 2006
- Incorporated into the MSHA Approved Emergency Response Plan, April 2007
- Structure was certified as exceeding the 15 psi strength requirements in 2009.
- Structure and Door were certified as exceeding the 15 psi strength requirements in 2010.
- Part 7 Approval was achieved in 2014.
- Continue to install at 6000 foot intervals.



Major Driver for this Decision

Time To Increase CO₂ Levels From Normal To Fatal
Barricading Volumes and Equivalent Number of Crosscuts

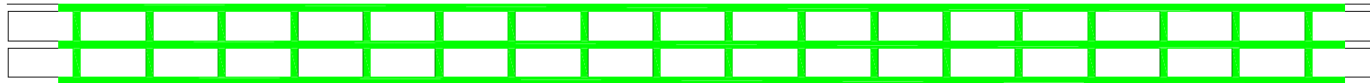
No. Of Miners	Time (Hrs)	Vol (ft3)	No. Of 203 XC's
1	1	3505	0.96
	4	14018	1.05
	12	42054	1.28
	24	84109	1.63
	48	168218	2.34
	72	252327	3.04
	96	336436	3.74
	120	420545	4.44
	144	504653	5.14
	168	588762	5.84
	192	672871	6.54
	216	756980	7.24
	240	841089	7.94



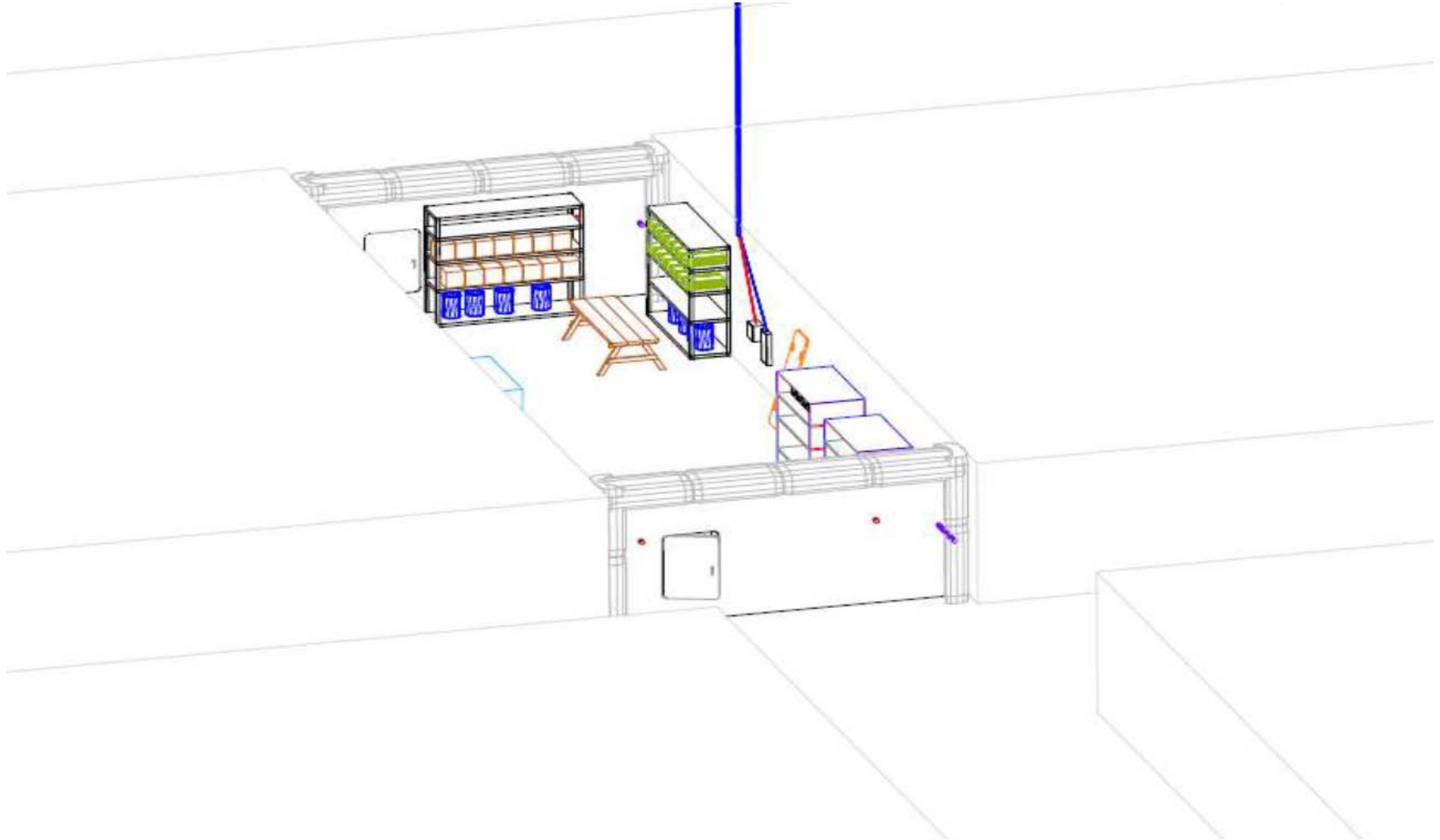
Barricading Space Required

Time To Increase CO₂ Levels From Normal To Fatal
Barricading Volumes and Equivalent Number of Crosscuts

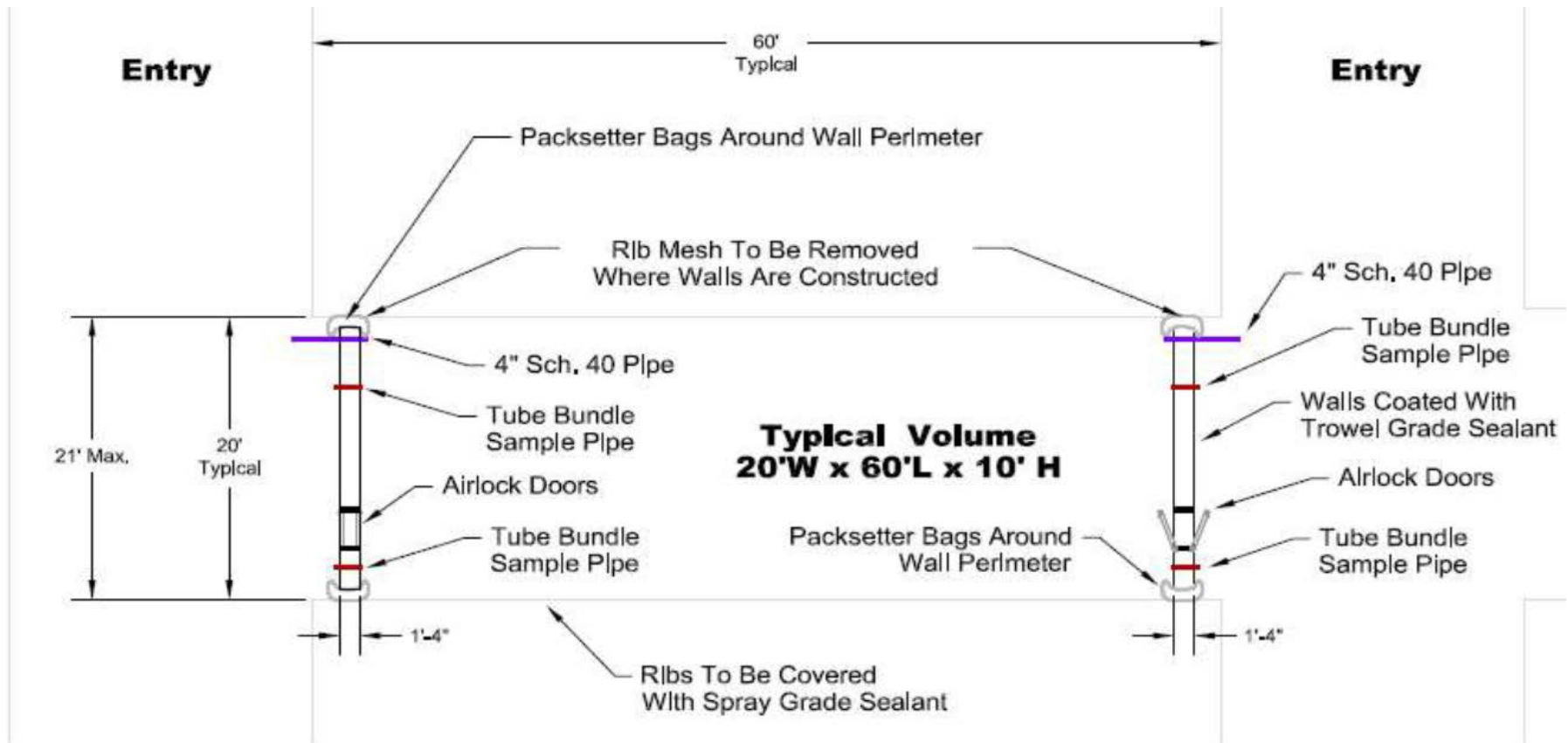
No. Of Miners	Time (Hrs)	Vol (ft ³)	No. Of 203 XC's
12	1	42054	1.28
	4	168218	2.34
	12	504653	5.14
	24	1009307	9.34
	48	2018614	17.76
	72	3027921	26.17
	96	4037228	34.58
	120	5046535	42.99
	144	6055841	51.40
	168	7065148	59.81
	192	8074455	68.22
	216	9083762	76.63
	240	10093069	85.04



Typical Construction Details



Typical Construction Description



Roof Support Will Be Per The MSHA Approved Roof Control Plan. Supplemental Rib Support Will Be Evaluated On A Site-Specific Basis, But Will Typically Consist Of Chain Link Or Mesh With Rock Props.

Typical Stopping Wall Construction Will Be As Per A Mitchell-Barrett Wall - Dry Stacked Solid Concrete Block Layed In A Transverse Pattern. Hitching Is Not Required. A Plaster Will Be Utilized As Required On A Site-Specific Basis. Overall Chamber Design Will Be Evaluated On A Site-Specific Basis.

Maintenance of Atmosphere

- Large vent pipe is open during normal operations, closed during actual use.
- Equipped with a check valve to prevent air reversing through the pipe.
- Dual sampling ports for sampling the mine atmosphere outside the RA.
- A second vent pipe is equipped with a pressure relief valve.



Interior View of An Early Version



Interior Photo of Current Installation

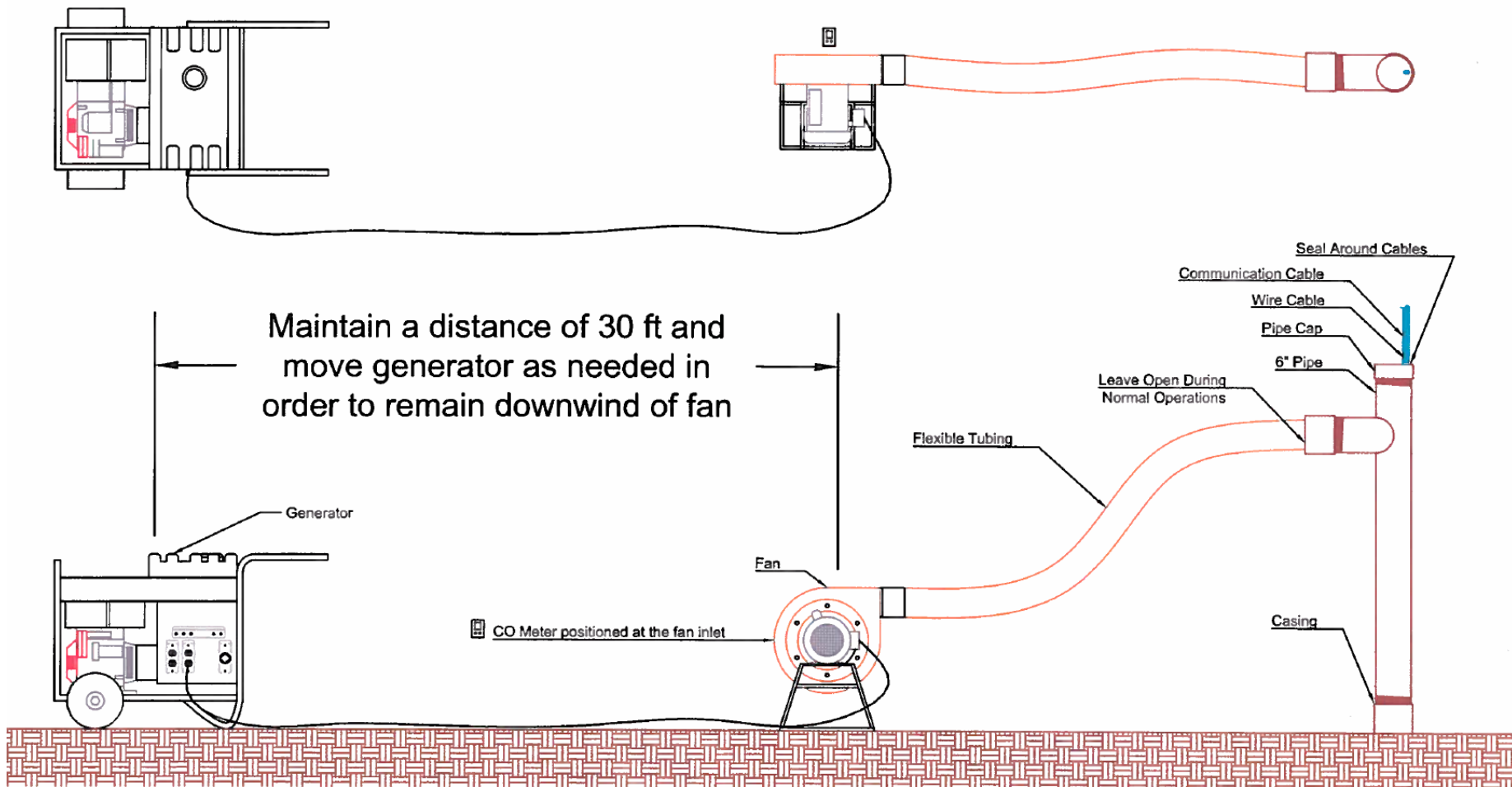


- Supply containers with tamper-evident seals.
- Improved storage shelving.

Underground Supplies List

Supply Materials	Quantity	
	Gateroad	Mains/Submains
10'X25' brattice	10	15
Fire extinguisher	1	1
Pager phone	2	2
Picnic tables, folding	2	4
Industrial Scientific MX6 Refuge Chamber Kit	1	1
Simplex roof jacks	4	4
Wool blankets	15	30
Trauma kit/O2 & stretcher	1/shelter	1/shelter
Eye wash station with 2 bottles of saline	1	2
Built in urinal	1	1
Bag toilet & bags	1	1
Biohazard containers with bags	2	4
Paper coveralls	4	8
water (clean up, wash, toilet, etc.)	30 gal	60
water in individual 4.22 oz. containers (5 yr life)	640	1280
Dried foods, 5 yr life, (44 # 9 cans of assorted dried fruit & 99 energy bars)	1 set	2 set
Cots	4	4
MSHA Approved portable lights - (Streamlight or Equiv)	2	2

Surface Component Typical Layout



Typical Surface Borehole Site



Borehole Support Trailers



- **Borehole Support Trailers**
- **Stored at a central & secure location**
- **Equipment examined and tested on a regular basis.**

Trailer Materials	Quantity	
	Gateroad	East Mains
Generator	1/borehole	1/borehole
Carbon Monoxide Detector set to alarm at 10 PPM	1/borehole	1/borehole
Fans	1/borehole	1/borehole
Ventilation hose/tubing	1/borehole	1/borehole
Lighting	1/borehole	1/borehole

Borehole Support Equipment



Ventilation Survey Data – Part 7 Application

BIP RA Location	Wall to Wall Length (ft)	Floor to Roof Height (ft)	Rib to Rib Width (ft)	Ambient Noise Level (db)	Ambient Noise Level with Fan (db)	Ambient Inside Temperature (F)	Ambient Surface Temperature (F)	CFM W/O Aux Fan (Adjusted)	CFM W/ Aux Fan (Adjusted)
EMXC 35	44.5	10	18.75	52.2	62	64	99	78	270
EMXC 72	31.5	10	18.05	55	61	64	79.7	191	468
EMXC 107	53	10	19	48	54	71	99	78	397
WSM XC 1	68.1	8	18	61	63	65	86.6	174	374
GR-400 XC 24	35.5	11.3	21	40.2	47.8	66	96.3	110	321
GR-401 XC 22	66.5	9.5	18.3	48	50	67	95.4	110	302
GR-401 XC 48	78.5	9.4	22.3	38.2	48.1	72	93.1	302	480
GR-402 XC 16	66.5	10	18	45	50.3	66	93.2	220	480
GR-402 XC 42	61.8	9.5	19.8	34	58	66	89.5	302	499

Key Points

- Major ventilation changes can impact RA ventilation and its performance.
- Regular inspections of ventilation, supplies and RA conditions are necessary.
- Exhausting ventilation fan maintains fresh air flow continuously. Borehole fans enhance that ventilation volume.



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