draft

SUDBURY NEUTRINO OBSERVATORY

ACRYLIC PANEL BONDING TESTS

SNO Research Station
Creighton Mine
March 1992

E.D. Hallman, D.L. Cluff, D. Cloutier
Laurentian University

Report SNO-STR-92-027

The SNO Research Station Clean Room

A former lunchroom on the 4600 foot level of the Creighton Mine was converted to a research station in early 1992, through the construction of a concrete block wall, steel door and the installation of power outlets, lighting fixtures and a ventilation fan. Figure 1 shows the floor plan and dimensions of the room.

Surfaces and Partition

Wall and floor surfaces in the room were covered with a 4" shotcrete layer, followed by an Oxyguard 100 epoxy primer coat (see specifications in Appendix 1) designed to chemically bond to concrete surfaces. Two spray coats of Oxyguard 305 a gray high-build finishing epoxy formed a finishing layer about 1 mm thick. The epoxy was sprayed directly on to the existing shotcrete surface with no remedial preparation except for the removal of any loose material and a spray cleaning with water. The partition, shown in the floor plan, was installed to separate the semi-clean area from the clean area. It was constructed of drywall and plywood and sealed at the concrete surfaces using caulking and/or polyurethane foam. A 36 inch standard wood door and frame with a weather strip seal was installed as shown. The partition was primed and coated with the high-build epoxy.

Air Circulation and Ventilation System

Air from the drift is drawn into the laboratory by a 300 cfm fan, through a 2 ft x 1 ft x 8 inch cartridge filter (with efficiency about 75% for particles above 0.5 micron diameter), mounted in the drift outside the clean room. The prefiltered air then passes through a 2 ft x 2 ft x 6 inch HEPA filter (99.99% efficient for particles above 0.5 microns) mounted about 2 ft from the fan in a tapered duct, inside the clean room. The flow rate with full filtering is approximately 200 cfm. Inside the clean room, air can be recirculated through a "Clean Ceil" blower unit mounted either horizontally or vertically 6 feet above the floor. This unit contains a prefilter and a 4 ft x 2 ft x 6 inch HEPA filter and can recirculate air at rates up to 700 cfm. The exhaust air from the clean area flows through a 2 ft square x 4 inch thick prefilter installed in an opening above the entrance to the clean room.

Initial Clean up of the Clean Area

The construction of the partition generated a considerable amount of dust and dirt including sawdust, masonry dust and mine dirt. After the construction of the partition, the painted walls and floor were spray cleaned with mine supply water. Since the epoxy surface is not wetted by water, all water sprayed on the walls flowed to the floor except for some small beads. The epoxy surface was found to shed dust and dirt remarkably well, so that even with the relatively uneven wall surface, a simple water spray does a good job of removing any surface dirt that has collected. The dirty water on the floor was wet vacuumed and disposed of in the drift. A second cleaning with clean water brought from the surface was performed using a sponge mop and the wet vacuum. A final coat of epoxy was then applied to the floor in the clean area. From this point on, clean mine boots, formerly worn in this area, were not allowed. Standard coveralls and socks work were considered acceptable for final installation work: clean room clothing was reserved for the period of final air recirculation prior to any clean room test work.

Particle Count Measurements

Air cleanliness was assessed during the final cleanup stages and after using a Met One laser particle counter (Model 227B) with a sampling rate of 0.1 cu ft per minute, and particle count channels for dust above 0.3, 0.5, 1.0, 3.0 and 5.0 microns (2 channels selectable including 0.3 and one of the other four size ranges at a time). After the ventilation system had been in operation for three days, it was found that the class of the room improved from Class 100,000 cleanliness initially, to Class 10,000 (see Appendix 2 for particle concentration limits for these classes). The area under the recirculating system was found to reach Class 100 cleanliness on average. Figures 2 and 3 show particle count results versus time in the clean room area, and the particle size distribution for typical air during the bond test period.

Orientation and Bonding Process Schedule

A 'Failsafe' meeting to review materials and procedures for the bond test work was held at the Inco Engineering Office on March 4, 1992. Personnel attending included SNO representatives, Inco supervisors, Inco environmental and safety officials and two representatives of Reynolds Polymer Technology (RPT) which was to perform the bond test work. The minutes of this meeting are included in Appendix 3. In general, the bonding process, delivery and storage of materials, potential hazards, schedule and procedures to be followed were discussed. Requirements agreed to in this meeting for the bonding work included:

- the shipment of chemicals underground in a secondary closed metal cannister,
- the accompanying of chemicals, on the hoist and during underground transit, by SNO personnel,
- the removal and disposal of any chemical/material waste by SNO personnel at Laurentian University.
- the initial measurement of methyl methacrylate vapour in an underground test to ensure suitably low levels.
- the installation of a respirator, fire extinguisher and other standard safety equipment in the laboratory.
- the limiting of the maximum temperature which could be reached by the heater tape/power supply to a safe value, to prevent temperature runaway during unattended operations.

Because of an interruption due to the changing of the hoist cable at the Creighton Mine, the orientation of the RPT personnel was scheduled for March 6, followed by about 4 hours of initial work. Since the full underground safety program was not taken by Reynolds personnel, all work was to be carried out with Inco representative, Larry Carriere, present.

Initial Preparation

Chemical Vapour Concentration Measurements

Levels of methyl methacrylate monomer (MMA) vapour were measured in a test under ventilation conditions identical to those for the bonding work, in the underground laboratory, to assess potential vapour hazards. Tests were carried out near an open 500 ml beaker of the monomer, using 'Gastec' sampling pump and designated cartridge #141 for this chemical (with a minimum detection limit of 50 ppm). Results of three separate measurements at locations near the beaker are given in Table 1. It is clear that, for this exposed liquid surface area (comparable to those exposed during the bond test work) levels of vapour at distances greater than 10 cm from the surface are well below the threshold limit value of 100 ppm, and are acceptable. In fact there was no detectable smell of the chemical outside the research station throughout the test - probable levels of the monomer in this area were in the 1 ppm or less range (since the odour threshold for MMA is less than 1 ppm). A standard procedure for evacuating the laboratory in the event of a spill of this chemical, or ventilation interruption, was adopted. The available respirator would be used for spill cleanup or rescue as required. Waste containers and clean-up equipment were on hand.

Table 1 Methyl Methacrylate Vapour Levels
Measured above and near a 500 ml beaker containing 50 ml monomer

Height (cm) (above liquid)	Concentration (ppm)	Notes
1.0	> 3000	1 air volume through tube
10.0	1100	top of beaker
10.0	400	outside top edge
50.0	< 40 (not detectable)	50 cm horizontally from beaker

Preparation of the Acrylic Slabs at Laurentian University

The acrylic panels were shipped from RPT by air freight in containers which had a 1/8 inch wood panels taped to cardboard corners to form the outer package, but no plastic wrapping. The shipment was received at Laurentian University about 2 weeks before the bond tests were scheduled. The panels were unpacked and inspected by RPT personnel, in the SNO laboratory at Laurentian, and then cleaned using MMA monomer. Some dirt and remnants of tape on the panels were removed in this process. The acrylic panels were then brought to a photographic darkroom across the hall from the SNO laboratory and washed, using Fisher 'Sparkleen' detergent, in a large stainless steel sink which could accommodate the entire acrylic panel. During the washing of the panels by the RPT personnel, particle counts were taken; the laboratory was found to be at about class 50,000 at the time. After washing, the panels were allowed to air dry for approximately 30 minutes and then double wrapped in standard 6 mil commercial polyethylene and banded together in pairs. They were delivered to the mine in a SNO vehicle and loaded on to a rail car for accompanied shipment underground on 1992-03-05.

Summary of Bond Test Work

The following log book summary outlines the steps and measurements made during the bonding test. Photographs of various steps in this work are given in Figure 4.

1992-03-06
D. Earle, K. Dougherty, and W. Nagurski completed the Creighton Mine orientation program by 11:00 am. Along with L. Carriere, the above group met D. Cloutier and D. Cluff at the 4600 ft level research laboratory. The protocols of entering the clean room and bringing in materials and equipment were discussed for about 30 minutes. The equipment, jigs, panels and tools were unwrapped (outer layer) in the semi-clean area, and brought into the clean room, where the inner plastic layer was removed. Personnel were dressed in disposable "clean room" coveralls, boot covers and hair covers while in the clean room. The initial set-up, cleaning of the equipment and the placing of the panels into the supports, was started. Airborne particle counts in the clean area for each day are shown in Figure 2.

1992-03-07
The cleaning of the bond surfaces, and setting up of the bond gaps and equipment was completed. The bond surfaces of the acrylic panels were primed, the adhesive coating applied and the silicone dams installed. The finished bond assemblies were then left to cure until 1992-03-09.

1992-03-08
Sunday - no work scheduled

1992-03-09
The silicone dams were sealed with an aluminum tape. Catalyzed monomer was transferred to beakers and to the polypropylene injection tubes. Monomer was poured directly into the top of the horizontal bond. The monomer was injected into the vertical bond from the bottom using the injection tubes and a caulking type gun. The pouring or injecting of monomer into both bonds took about one hour to complete. After the monomer had settled, heater tapes and insulation were fixed to the length of the bottom side of the horizontal bond and to the lower section of the vertical bond. Electrical power to the heater tapes was supplied are through ssimple on-off temperature controllers set to 115°F nominal temperature for both bonds. Variable transformers were inserted into the circuit between the temperature controllers and the heater tapes to limit the increase in temperature

should a controller fail. The temperature increase was monitored by an independent thermocouple; no irregularities were noted. Measurements of the number of dust particles/unit air volume were taken with a laser particle counter to estimate the class of the clean room during this process. Results showed the room to be close to CLASS 10,000 cleanliness (see Figure 2).

1992-03-10
At 12:30 pm, on arrival, it was found that the lower 12 inches of the vertical bond had developed some voids (gas bubbles). It was suggested that this was possibly due to the movement of the jig support which allowed an extra amount of monomer to settle to the bottom of the bond. It was noted that the temperature probes indicated that the actual temperature at the bonds was lower than the controller set temperature. It was decided that the variable transformer should be removed from the vertical bond temperature control circuit in order to allow for normal operation of the temperature controller. Even with this transformer removed, power capabilities of the control unit would not permit a large unsafe excursion of temperature. A thermocouple was placed on each panel and connected to a chart recorder so that the temperature cycling could be continuously recorded.

1992-03-11
No further exothermic reactions were found in either bond. The heater tapes and insulation were moved to the upper section of the vertical bond with the temperature being left at about 120°F. The horizontal bond cure line had moved close to the top of the dam, thus, the heat tape was moved to the upper section of the panel and the temperature was increased from 152°F to about 173°F. A failure of the chart recorder drive prevented any further collection of temperature cycling data, but records obtained showed that the temperature cycles were within acceptable limits.

1992-03-12
It was found (on entry) that the horizontal bond temperature was about 25°F less than controller setting while the vertical bond temperature was about 120°F ± 3°F just at the temperature control setting. It appeared as though the variable transformer which was still in the horizontal bond temperature control circuit, was the cause of the horizontal bond temperature difference. After this transformer was removed from the circuit the temperature of the vertical bond was increased to about 165°F. A cool-down procedure, at a rate of -10°F/hour, was started on the horizontal bond. The vertical bond was left at a constant temperature of 165°F.

1992-03-13
The horizontal bond temperature was 117°F and the vertical bond was at 168°F when the laboratory was entered in the morning. The cool-down cycle was started on both bonds and by 10:00 am, the horizontal bond cycle was complete with the acrylic at about 104°F, and the temperature controller turned off. The cool-down cycle for the vertical bond was continued until about 1:05 pm at which time this controller was turned off. The temperature of the acrylic was about 115°F at this point. The laboratory temperature was 71°F, with relative humidity measured at 65%.

1992-03-14
Before any finishing of the acrylic surface could begin, the silicone dams and aluminum tape had to be removed from the acrylic surface. This was a messy process, producing bits of silicone rubber, dam and aluminum tape debris. The initial grinding of the bond surfaces was performed with a surface router. It took about 2 hours to complete the initial cutting off of excess material. The laboratory clean area was cleaned up and the "Clean Ceil" recirculating fan was started up again. The laboratory temperature was 70°F ± 2°F, with relative humidity measured at 66%.

1992-03-15
Sunday - no work scheduled.

1992-03-16
The first side of the bonded acrylic panel to be sanded was the heated surface of the vertical bond. An air-powered rotary grinder was used throughout, with grits and grinding times as listed below.

Grit #	Time(min)
40 dry	150
80 dry	30
120 wet	30
180 wet	30
320 wet	10
400 wet	10
600 wet	15

This series of grits is a good approximation to that used by RPT. During the grinding there were occasional changes in the air supply pressure. These changes meant longer grinding times than usual, but they were not detrimental to the acrylic surface finish. The #40 and #80 grits are normally used in a wet grinding process at RPT. After some dry grinding, the paper was used successfully in a wet process, although the lifetime of the paper was considerably reduced. At the end of the shift this side of the vertical bond had been essentially completed. Laboratory temperature was 70°F ± 2°F, with relative humidity 63%.

1992-03-17
The cold side of the vertical bond was ground according to the following procedure.

Grit #	Time (min)
40	150
80	30
120	40
180	20
320	10
400	10
600	10

A wet grinding process was used for grit sizes above 80. By the end of the shift, the vertical bond had been completely finished.
Laboratory temperature was 70°F ± 2°F, with relative humidity 61%.

1992-03-18
Using #40 grit paper, the top side of horizontal bond was ground for approximately 150 minutes. The grinding of the bottom side of this bond required an additional 60 minutes. The coarse grinding was continued until about noon when the grit was changed to #80. Since lesser grinding times are required as the grit size is decreased, it was possible to complete the grinding process on both sides of the horizontal bond by the end of the shift. Less time was required for the horizontal panel, since there was less mismatch in the sections for this panel than for the vertical panel. The panels were washed with clean water, wrapped in plastic and placed under the Clean Ceil fan.

Shipment of the Completed Panels for Analysis

Special shipping crates made of 1/2 inch plywood with a 1 inch styrofoam insulation layer were constructed at Laurentian University. These were delivered to the underground research station on 1992-04-03. The bonded panels were wrapped in a layer of clean 6 mil polyethylene sheet, packed into the boxes and removed from the mine on 1992-04-07. Although considerable acrylic dust was still present, it was decided not to clean the panels further, but to leave final cleaning to be carried out at Chalk River. These acrylic panels were returned to the university then shipped to Chalk River Laboratories by transport the following day.

Observations and Recommendations

The clean room should have a tack mat at the entrance from the semi-clean area to the clean area. The air pressure of the mine compressed air supply (90 psig nominal) was found to fluctuate; a compressor at the site would ensure consistent pressure. Some clean room wear such as boot covers should be designated as single use items; some dirt evident on the sole of the boot covers used was probably acquired mainly from the semi-clean area during the change from mine clothes to clean room wear. We are concerned about the generation of particles during some processes in the clean area. For example, during the grinding process, the class of the room was as high as class 10^6. Considering that the majority of the particles were due to the grinding process, radioactivity contamination of nearby surfaces would not be expected, but it would become difficult to determine the difference between mine dust and acrylic dust, so that a sudden filter failure or influx of particles generated from some other source, might be undetectable. In general, underground work is significantly affected by the cage schedule, and the concern that a missed cage could mean a long underground stay. Shift work on bonds will help minimize this problem. As much redundancy as possible re early supply shipments and process steps should be built into procedures, to allow for inevitable delays in cage schedule and other mine factors. Clean water was not available from the mine supply (a high rust content was always present) and clean tap water for final cleanups had to be brought from the surface. A filter will be added to a water supply line to the research station. In the SNO laboratory, it is clear that a separate filtration should be planned for any clean operations prior to the completion of the SNO water system.

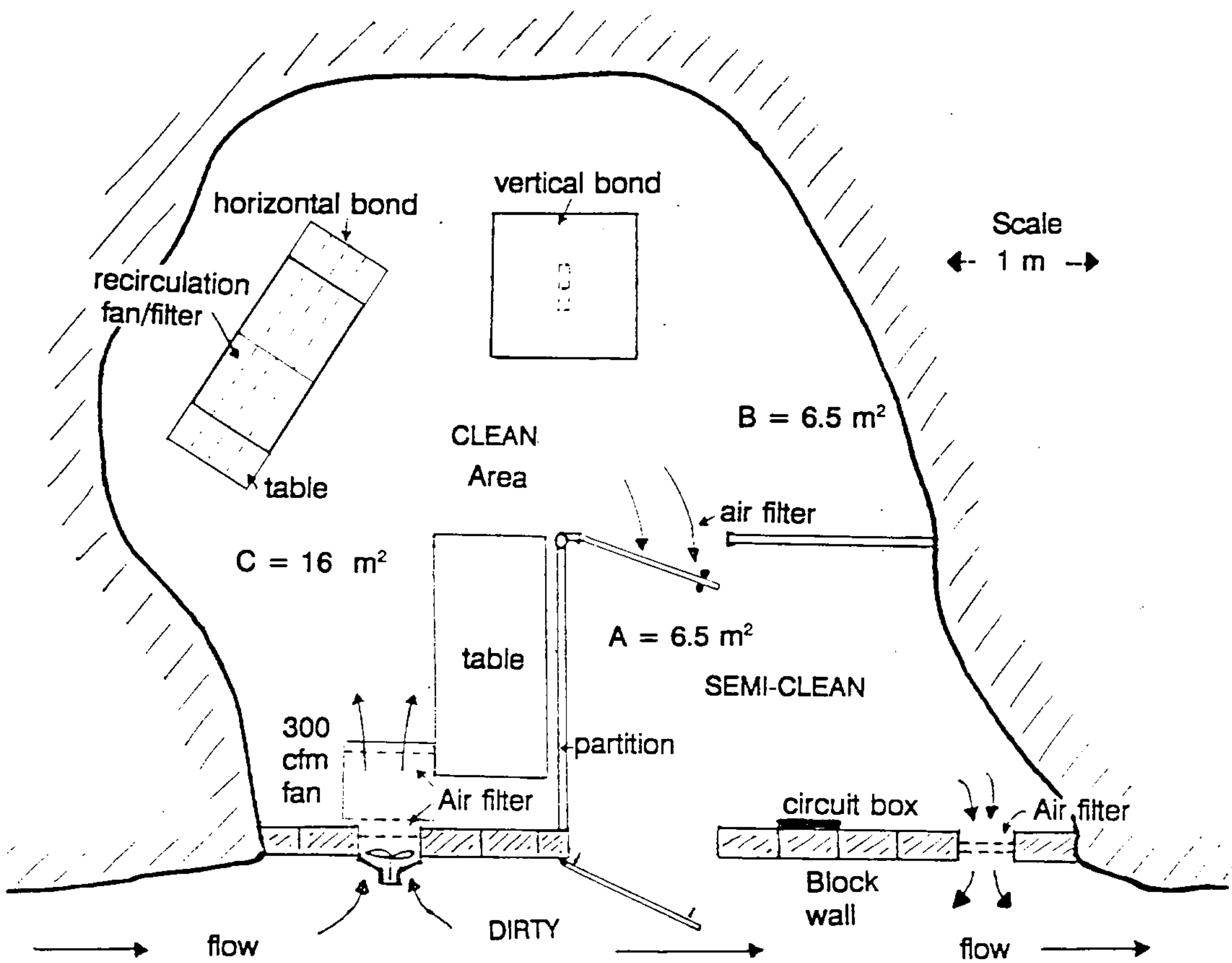


Figure 1: SNO Research Station floorplan (4600 ft level, INCO Creighton mine).

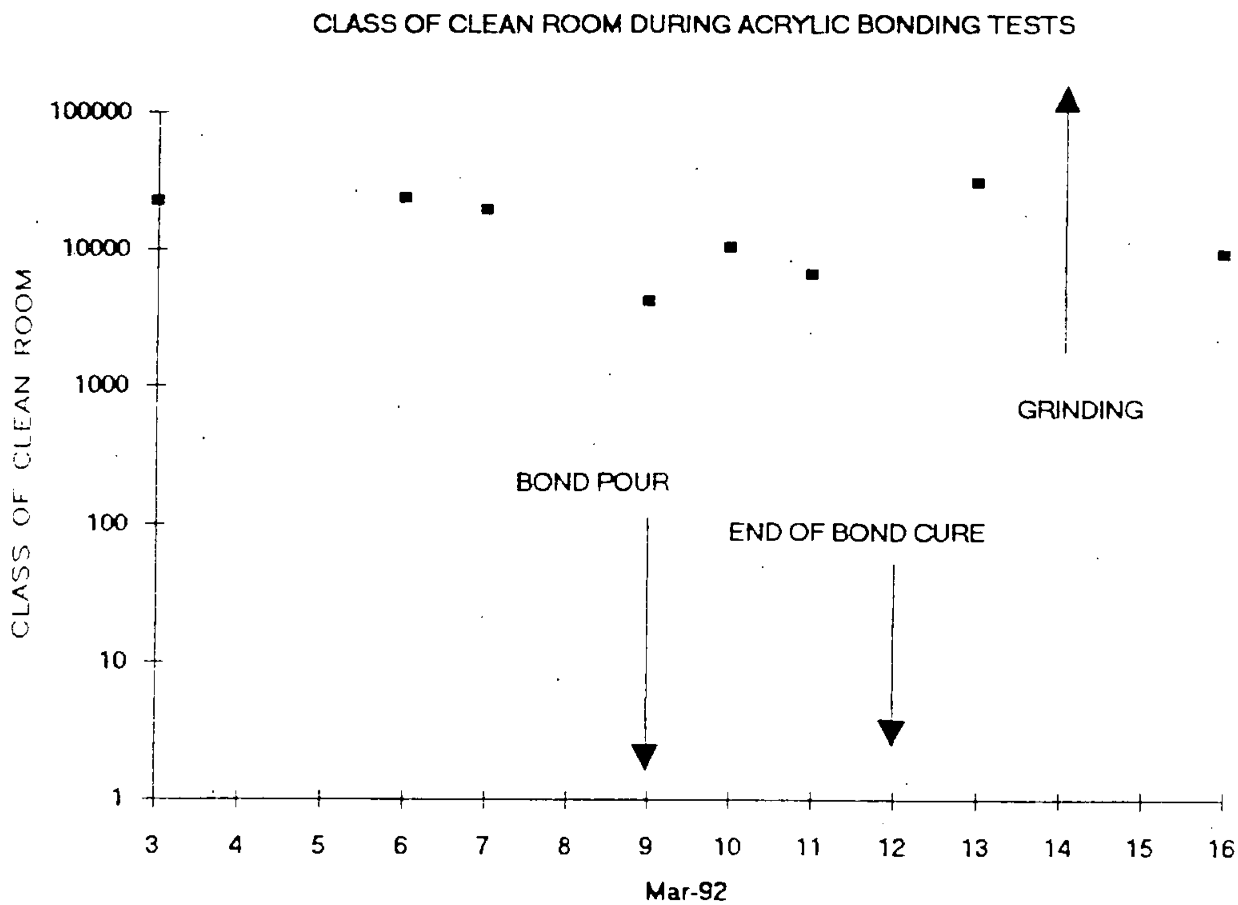


Figure 2: Clean room particle count summary during the bond test period. During grinding,class numbers close to 1,000,000 were observed.

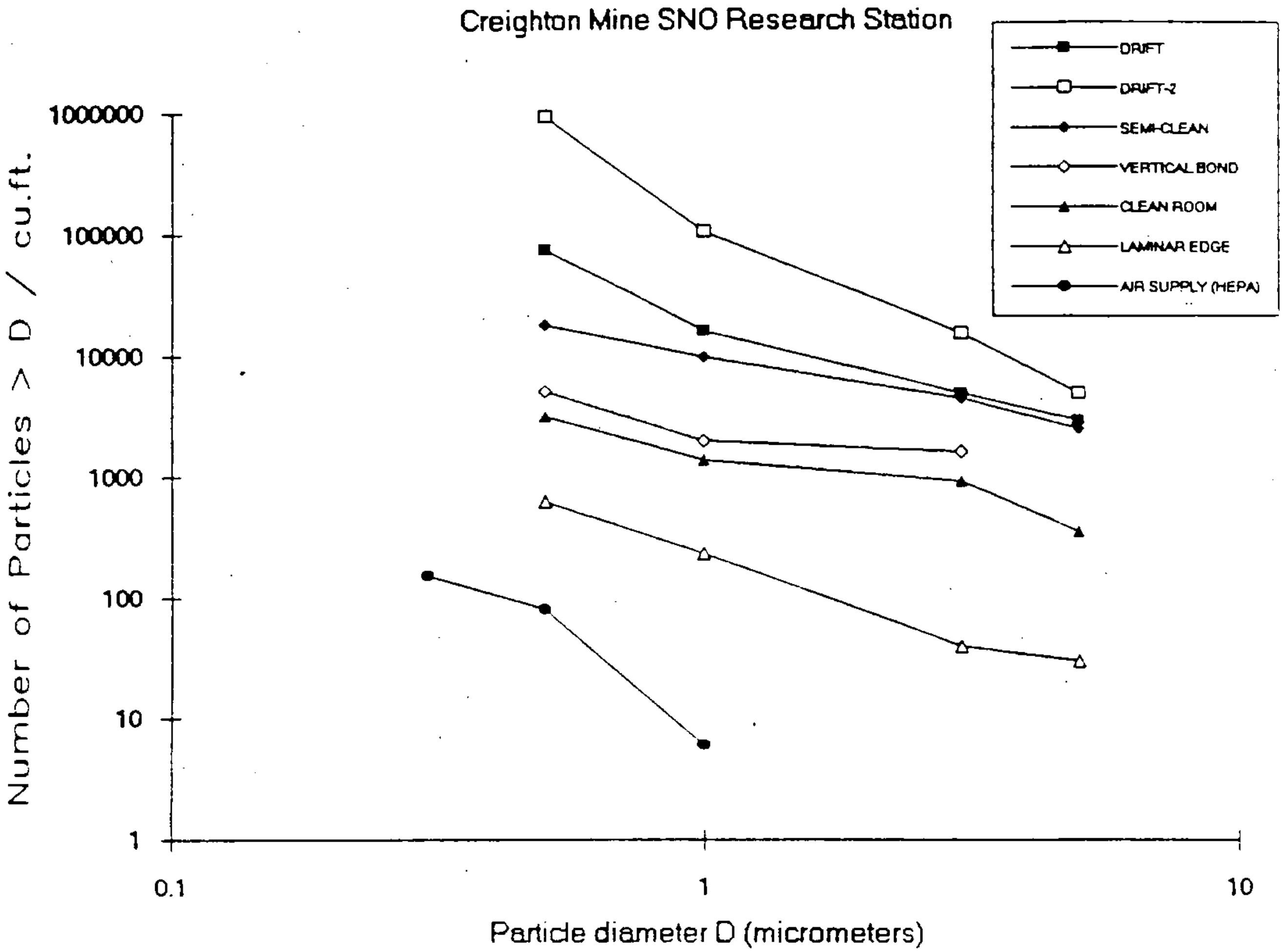


Figure 3: An analysis of particle number vs diameter for clean room air for March 09 (except for drift which was taken March 06) during the bond preparation period. In general on the log plot, linear relationships are observed with slopes near those expected from the clean room class definition. (Appendix 2)

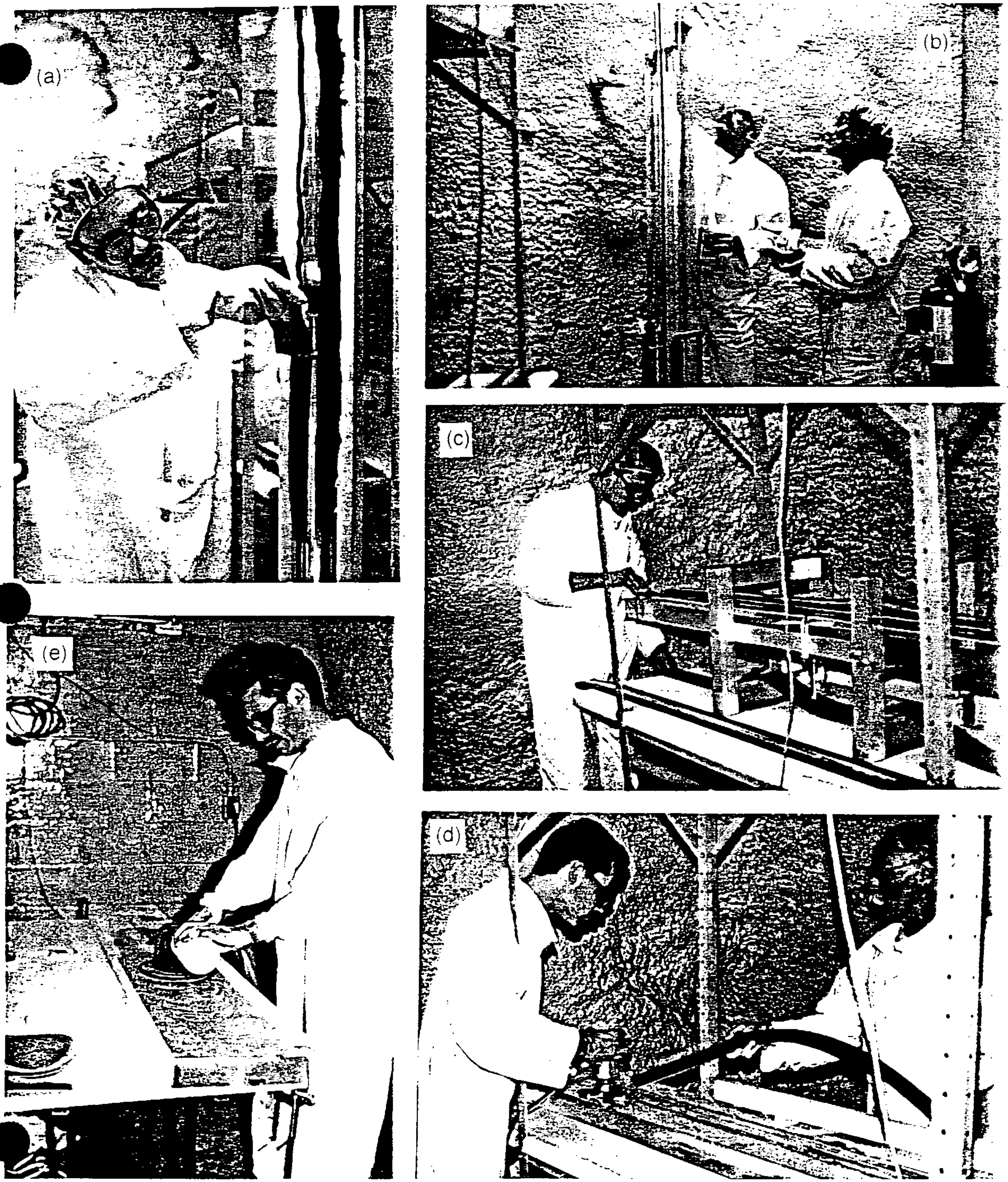


Figure 4: Steps in the bond test process. (a), (b) (c) preparation of dams for both bonds. (d), (e) router and grinding work for bond finishing.

OXYGUARD 300

Chemical Resistant High Build Epoxy Coating.

Description

Solventless, room-temperature and rapid curing 2-component epoxy-resin based coating. It provides a high gloss, tile-like finish which is tough and sanitary, and a compromise between ease of maintenance and non-skid characteristics.

Uses

Primarily designed to topcoat jointless floor toppings to provide a waterproof, chemically resistant barrier. Applied as a coating with a broadcast aggregates to protect against corrosion, wear and skidproof steel, wood or concrete.

Characteristics

Application	: brush, short-nap roller, squeegee or airless spray. heavy coat, more than 1.5 mm (1/16") of thickness should immediately be deaerated with a piked roller (wear spiked shoes).
Color	: light and medium grey, tile red, and special colors are available on request
Cure time	: 8 to 12 hours for light traffic at room temperature
Dilution	: 5 to 10% by volume for brush and roller 10 to 15% by volume for spray using OXYSOLVE 950
Mixing	: mix thoroughly for 3 to 5 minutes using a mechanical mixer
Mixing ratio	: 1 to 1 by volume
Odor	: very low, and none when cured
Safety	: avoid skin contact, provide good ventilation and protective gloves, and wash hands with mild soap and water
Storage	: at room temperature
Surface preparation	: all surfaces to be coated must be sound and free from contaminants
Toxicity	: safe to handle, non-toxic when cured, ASBESTOS-FREE
Working time	: 15 to 25 minutes without dilution and 35 to 45 minutes with dilution at room temperature

Properties

Compressive strength	(ASTM D-695)	50.0 MPa (7300 psi)
Tensile strength	(ASTM D-638)	31.0 MPa (4500 psi)
Ultimate elongation	(ASTM D-638)	3.0 % or more
Water absorption	(ASTM D-570)	1.5 % or less

Limitations

Application of OXYGUARD 300 is not recommended when ambient and/or substrate temperature is below 5°C (35°F).

BMS mfg inc

OXYGUARD 100

Deep Penetrating Epoxy-Resin Based Coating.

Description

Clear, low viscosity, room-temperature curing 2-component epoxy coating designed for penetrating, reinforcing and sealing concrete, stone, brick-work, wood and other porous construction materials, and also metals.

Uses

It's the perfect foundation for any heavy-duty, water, chemical and abrasion resistant coating and topping systems and also, it's an ideal concrete floor sealer, due to its exceptional characteristics:

- easy one to one mix by volume
- no induction time needed with long pot life
- containing NON-POLLUTING solvent
- easy to apply by roller or spray
- rapid wetting and adhesion properties
- high penetrating and sealing properties
- a SINGLE application, at rate of 4 square metre per litre (200 ft^2/gallon), the cured coating will be glossy, without any pinholes, blush or other surface defects.

aracteristics

Application	: brush, short to medium-nap roller, squeegee using criss-cross technique and spray
Cure time	: 3½ to 6 hours at room temperature conditions
Mixing	: Mix thoroughly for 3 minutes using a mechanical stirrer
Mixing ratio	: one to one by volume
Odor	: very low and none when cured
Safety	: avoid direct skin contact, provide good ventilation and protective gloves, and wash hands with soap and warm water
Storage	: at room temperature
Toxicity	: safe to handle, and non-toxic when cured, ASBESTOS-FREE
Working time	: 3 hours or more at room temperature conditions

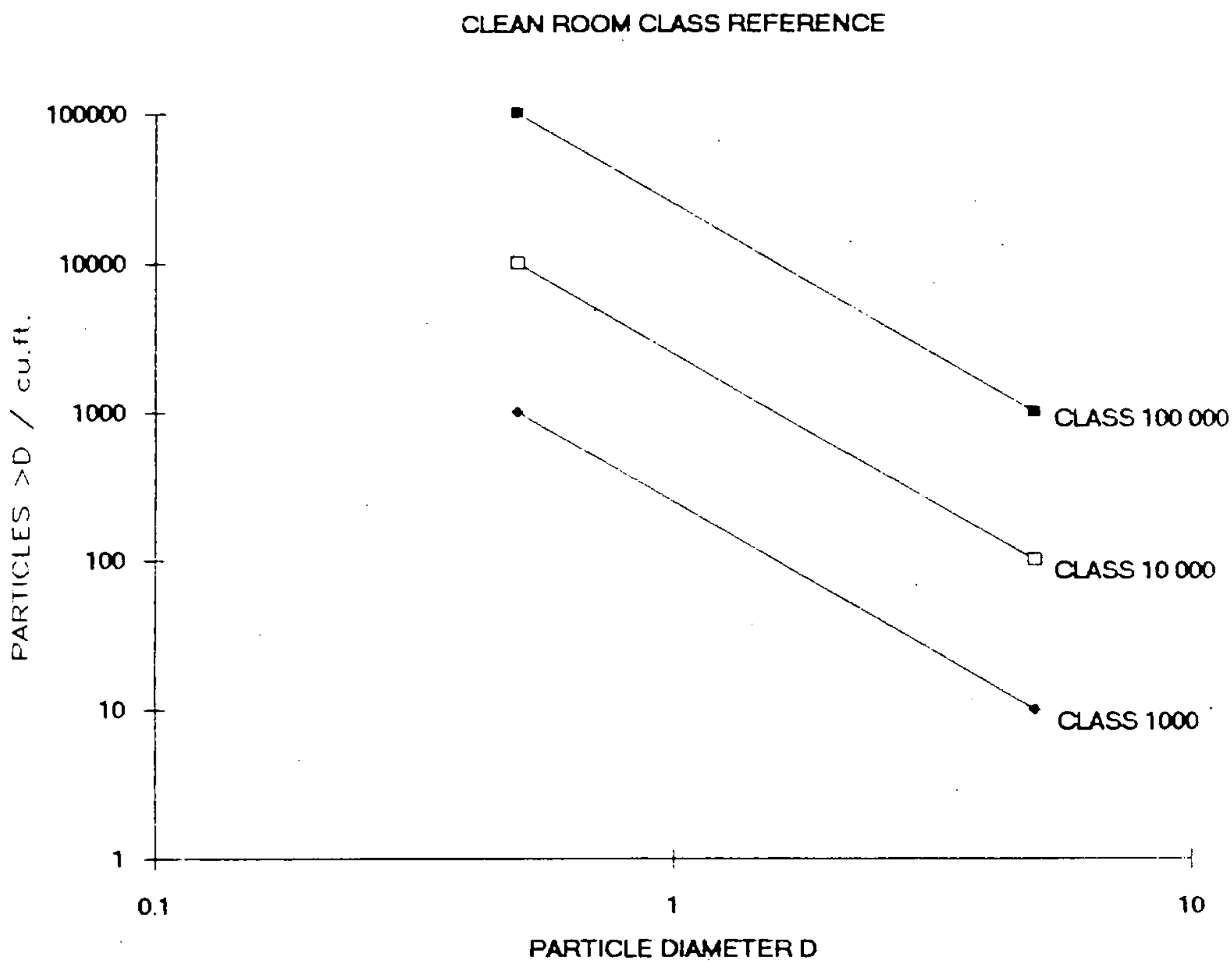
Properties

Hardness (Sward)	28
Abrasion resistance , mg (Taber CS-10, 1000 g, 1000 cycles)	110
Elongation (Conical Mandrel), %	35 or more

Limitations

Application of OXYGUARD 100 is not recommended when ambiant and/or substrate temperature is below 10°C (50°F).

CAUTION: components A and B are flammable, but containing non-toxic volatiles. Keep away from heat, sparks and open flame.



Appendix 2: U.S. Federal Standard FS 209D - Clean Room and Work Station Requirements, Controlled Environment. (1990)

SNO

CONFERENCE NOTES

PROJECT: 4600L Laboratory
Acrylic Bonding Tests

REF:

FILE:

BY: K. Coggins

DATE OF CONFERENCE: March 4, 1992

LOCATION: General Engineering Conference Room #1

PURPOSE: FAILSAFE of acrylic bonding test

ATTENDING:

Reynolds Polymer
Kevin Dougherty
W. Nagurski

SNOI/Laurentian U.
D. Hallman
D. Cluff

Inco
K. Langille
P. Todd
K. Coggins
R. Coulter
L. Carrier
T. McCourt
T. Mehes (Part time)

AECL
E. D. Earle

DISTRIBUTION: Those listed plus;
P. W. Pula
M. J. Sylvestre
F. Stanford
T. Price

CONFERENCE NOTES

1. K. Langille started meeting by giving a general overview of what was to be accomplished in this meeting.

2. All materials used in this test shall be approved by Occupational Health and Safety Departments and Environmental departments.

3. Peter Todd gave overview as to what a FAILSAFE is.

4. Tom Mehes talked about approval system for materials.

   There is the general Canadian control product regulation (WHMIS) and beyond it is the Inco hazardous product regulation program and respiratory protection program.

   From the programs materials are evaluated for ozone depletion substances, environmental concerns, and health hazards. Secondly they are put on a system of tracking.

   Occupational Health and Safety Department will create a station number for inventory tracking of our test substances.

5. Doug Hallman reviewed 4600L laboratory layout. He produced a handout describing laboratory features. (See attached).

6. Doug Hallman described refuge station and its operation.

7. Bob Coulter impressed upon group the necessity of signing in/out.

8. Kevin Dougherty described the test process.

9. The following questions were asked and answers given.

   i) ***What happens to wash effluent?***

   Panels will be pre-washed on surface and only wiped down in laboratory with isopropanol. Isopropanol will evaporate so as not to leave an effluent.

ii) *How will test items (panels, chemicals, etc) transported from the surface to the 4600L laboratory?*

Two basic groups of materials to be transported. The first are acrylic panels (72" x 6" x 2½"), electronics, and other non-chemical items. They will be transported in suitable containers.

Second group is chemical. They will be placed in approved containers and then separated into two groups. The preliminary chemicals will be put into one approved travelling barrel and the bonding agents will be put into a second approved barrel. This gives two lines of defense against spillage in transport.

iii) *How will transport be monitored?*

All barrels must have the appropriate labels. (Manufacturer's label or approved WHMIS)

Cage monitoring can be done in one of two ways:
- One is to have people at loading and unloading.
- Two is to have people ride up/down on the same cage. For purposes of the test the second monitoring method shall be used.

iv) *What gases are created during bonding?*

Methane is created in very minute quantities. Test laboratory air changes are 7/hr and cavity and drifts are 10/hr. This gives sufficient dilution.

v) *How much time is required for each section of the bonding test?*

Kevin Dougherty to produce schedule.

Due to Creighton #9 cable change on the cage, tests have been delayed. Creighton orientation is delayed. Bob Coulter to follow up as to when orientation can be done.

vi) *What is the heater and heater tape certification?*

They will definitely have UL but not necessarily C.S.A. certification. Doug Hallman to check.

vii) ***What hazards can be encountered during the test?***

Worst hazard appears to be failure of the thermocouple controlling the heaters. Dan Cluff and Doug Hallman have back up system in mind. They will forward it to Kip Coggins for review by Nick Volf in electrical engineering.

viii) ***Are there flammable materials?***

Acrylic panels and bonding syrup are flammable but will require an outside heat source to ignite.

Vapour from syrup has CO_2 and CO.

The possibility of an outside heat source to ignite the panels or bonding syrup is remote and should be covered under Inco's normal fire fighting system. No 24 hour watch is required during test.

ix) ***What about vapours from bonding?***

At the bond 10 ppm will be generated which is 1/10 of the TLV of 100 ppm.

Concern was expressed about people smelling a strange odour. A vapour emission test (Drager tube with sensitivity 50 ppm) will be supplied to verify that TLV has not been surpassed.

SNO to purchase respirator for laboratory.

x) ***Who reviews MSDS in field?***

People running the tests.
MSDS must be kept at laboratory.

xi) ***Are hard hats etc., to be worn in the laboratory?***

Bob Coulter to check with Creighton Safety people.

xii) ***Are there appropriate signs?***

No Smoking.
Flammable.
Ventilation Must Remain On.

xiii) ***Access key to Laboratory?***

Doug Hallman to supply Bob Coulter with key to lab which he will locate in a safe appropriate place.

xiv) ***What about disposable items?***

SNO to handle through Laurentian University.

xv) ***What about notifying production people in the mine about tests?***

Bob Coulter will compose and forward letter to mine people.

Dan Cluff asked to preview letter.

KC:kp

ACRYLIC BONDING TESTS
March 1992
SNO Research Station
4600 ft Level, Creighton Mine

1. Layout of the Laboratory

See floor plan (Figure 1).
Clean area separated by wood partition and door from semi-clean area. All surfaces, epoxy paint on shotcrete, concrete or wood.

2. Ventilation and Clean Air Equipment

Fresh air intake:
350 cfm fan with prefilter (2 ft x 1 ft) and high efficiency HEPA filter (2 ft x 2 ft) from drift to lab interior.
Clean air recirculator:
700 cfm 'CleanCeil' cleanroom recirculator with 4 ft x 2 ft HEPA filter. See Figure 2.
Room exhaust:
Prefilter (2 ft x 2 ft) above inner door.
Prefilter ((16" x 8") through wall to drift.

3. Power and Light

Panel on front wall.
Two 110V pair outlets one either side of door.

4. Laboratory Inventory

- 20 lb ABC dry chemical extinguisher (clean area).
- water hose.
- recirculation unit (clean area).
- 2 - 3 ft x 6 ft tables, 2 - chairs.
- laundry sink (no water supply or permanent drain).
- clean room coveralls, boot/hair covers.
- neoprene gloves, cloths, wipes.
- waste pail, cover.
- two station eyewash, first aid kit, ground leads for preventing static discharge.
- scrapers, mop, pail, wet/dry vacuum.
- tool kit.
- laser particle counter.
- telephone (outside line).
- chemicals, equipment and test samples as per Reynolds' list.

5. Additional Procedures Outline (draft)

- delivery of clean components, equipment to and from lab.
- delivery of chemicals to and from lab. (including waste).
- separate clean (or distilled) water container will be delivered to lab.
- informing of 4600 ft level personnel of schedule/type of work.
- unattended operations.
- sign requirements, including equipment tagging.
- storage of chemicals.
- emergency lighting - cap lamp on continuously in clean area.
- two supervisory personnel (INCO/SNO) always on hand, with one stationed in drift at all times.