FINAL PROJECT REPORT FOR THE DECONTAMINATION AND RELEASE OF THE BAUSCH & LOMB BATCH ROOM

BAUSCH & LOMB

ROCHESTER, NEW YORK

January, 1995

NES Document Number 82A8629

Prepared and submitted by:
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1. EXECUTIVE SUMMARY

NES/IES was awarded the contract to perform the decontamination and final release survey of the Bausch & Lomb Glass Plant Batch Room in December, 1994. Mobilization began on December 5, 1994, and the task was completed on December 15, 1994. Along with the decontamination of the Batch Room, four unaffected areas were surveyed for unrestricted release. Figure 1 shows the location of the Batch Room within the Bausch & Lomb Glass Plant.

The objective was to remove and dispose of contaminated materials from the Batch Room, and release the unaffected areas so the Glass Plant could be released for unrestricted use. At the end of the decontamination activities, a final release survey was performed within the Batch Room to verify that the decontamination efforts were successful (see Figure 2 for a diagram of the Batch Room). All building surface decontamination efforts were successful as evidenced by the final release survey. Surface contamination release level results complied with the "Guidelines for Decontamination of Facilities and Equipment Prior to Release for Unrestricted Use or Termination of Licenses for Byproduct, Source or Special Nuclear Material," USNRC, August 1987; and Table 5 of the New York Department of Labor Industrial Code Rule 38 "Ionizing Radiation Protection," June 29, 1994.

No personnel exposure to ionizing radiation in excess of 10% of state standards were noted during this work. Therefore 12 NYCRR Part 38.28, "Records" requirements are not applicable, as monitoring was not required pursuant to 12 NYCRR Part 38.24, "Personnel Monitoring."

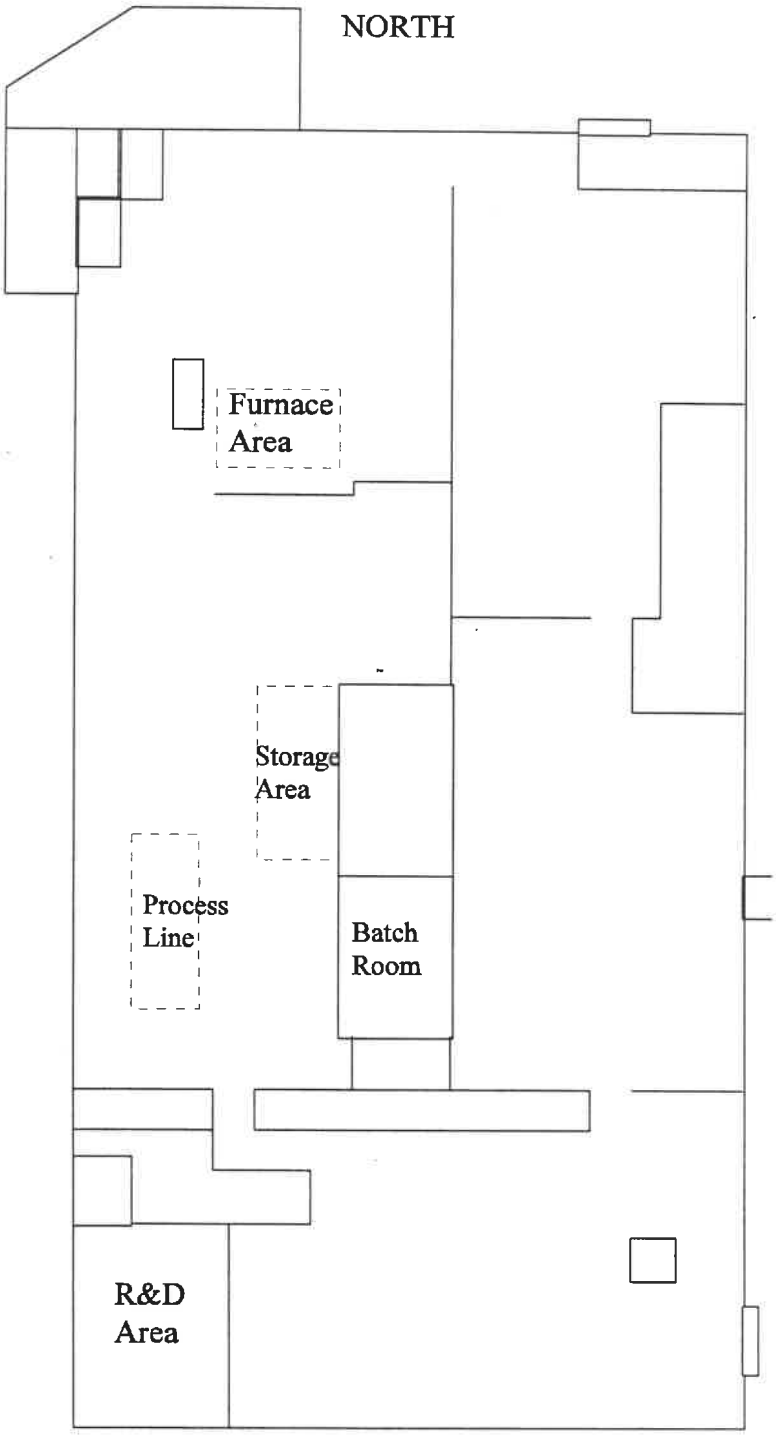
Radioactive waste was packaged and awaits disposal at Envirocare of Utah, Inc, pending sample analysis. The waste consisted of thorium contaminated concrete, sheet metal, miscellaneous debris and radioactive potassium.

2. WORK PLAN SUMMARY

The purpose of the work plan was to provide a logical and safe method for the decontamination of the Batch Room at the Bausch & Lomb Glass Plant located in Rochester, New York.

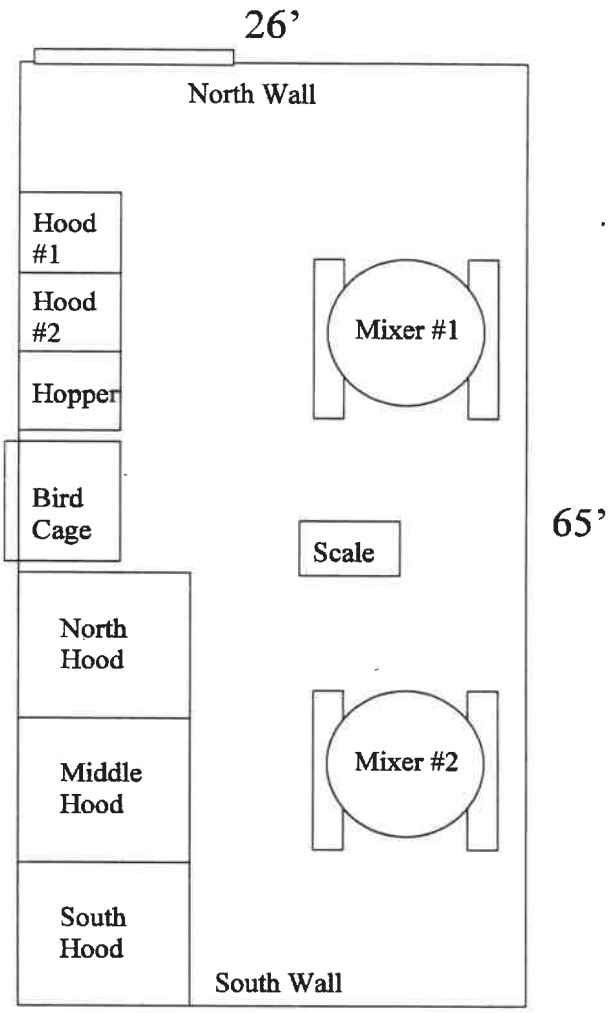
The goal was to decontaminate the facility to below the unrestricted release criteria. The final release survey was performed in accordance with NUREG/CR-5849, "Manual for Conducting Radiological Surveys in Support of License Termination," June, 1992.

Figure 1: Glass Plant



* Not drawn to scale.

Figure 2: Batch Room



* Not drawn to scale

The project was divided into seven tasks to ensure the requirements of Bausch & Lomb were met in the most cost effective manner. These tasks were:

Task 1 - Engineering
Task 2 - Mobilization
Task 3 - Perform Initial Survey
Task 4 - Scabble Floor
Task 5 - Final Survey
Task 6 - Demobilization
Task 7 - Final Report

3. SCHEDULE

NES/IES began mobilization and initial surveys on December 5, 1994. Decontamination activities began December 8, 1994. The final survey was started on December 12, 1994 and was completed December 14, 1994. Demobilization was completed on December 15, 1994.

4. RADIOLOGICAL PROTECTION

4.1 Radiation Work Permits

All decommissioning work within established Radiologically Controlled Areas (RCA's) was performed under the issuance of a Radiation Work Permit (RWP) prepared by the site supervisor. The RWP described the radiological conditions under which work in the RCA was to be performed. The RWP required the use of engineering controls and protective clothing, as necessary, to ensure that the work was accomplished in a radiologically safe manner while maintaining personnel radiation exposure as low as reasonably achievable (ALARA).

4.2 Contamination Control

RCA's were established where decontamination activities could generate airborne radioactivity or surface contamination. RCA's were isolated from the general work areas through the use of radiation barrier rope and warning signs. Prior to leaving an RCA, all personnel surveyed themselves with survey meters.

4.3 Airborne Radioactivity

Air samples were taken on a routine basis during all survey and decontamination activities within the Batch Room. The air samples were used to verify that the decontamination activities were not creating airborne radioactivity.

Airborne concentrations did not approach 2E-13 μCi/ml which would have required the use of respiratory protection.

5. RELEASE CRITERIA

Release criteria established for the decontamination of the Bausch & Lomb Batch Room is in accordance with the levels presented in USNRC draft Regulatory Guide "Guidelines for the Decontamination of Facilities and Equipment Prior to Release for Unrestricted Use or Termination of Licenses for Byproduct, Source and Special Nuclear Material," May, 1987, and Table 5 of the New York Department of Labor Industrial Code Rule 38, "Ionizing Radiation Protection," June 29, 1994. The criteria from the USNRC guidance is stated below:

Table 1: Acceptable Surface Contamination Levels

NUCLIDE[a]	AVERAGE[b c]	MAXIMUM[b d]	REMOVABLE[b e]
U-nat, U-235, U-238, and associated decay products	5,000 dpm α /100 cm^2	15,000 dpm α /100 cm^2	1,000 dpm α /100 cm^2
Th-nat, Th-232, Sr-90, Ra-223, Ra-224, U-232, I-126, I-131, I-133	1,000 dpm/100 cm^2	3,000 dpm/100 cm^2	200 dpm/100 cm^2
Beta-gamma emitters (nuclides with decay modes other than alpha emission or spontaneous fission) except Sr-90 and others noted above.	5,000 dpm β-γ /100 cm^2	15,000 dpm β -γ /100 cm^2	1,000 dpm β-γ /100 cm^2

[a] Where surface contamination by both alpha and beta/gamma emitting nuclides exists, the limits established for alpha and beta/gamma emitting nuclides should apply independently.

[b] As used in this table, dpm (disintegrations per minute) means the rate of emission by radioactive material as determined by correcting the counts per minute observed by an appropriate detector for background, efficiency, and geometric factors associated with the instrumentation.

[c] Measurements of average contaminant should not be averaged over more than 1 square meter. For objects of less surface area, the average should be derived for each such object.

[d] The maximum contamination level applies to an area of not more than 100 cm^2 .

[e] The amount of removable radioactive material per 100 cm^2 of surface area should be determined by wiping that area with dry filter or soft absorbent paper, applying moderate pressure, and assessing the amount of radioactive material on the wipe with an appropriate instrument of known efficiency. When removable contamination on objects of less surface area is determined, the pertinent levels should be reduced proportionally and the entire surface should be wiped.

In addition to the above guidance, dose rates did not exceed background by more that 5 μRem/hr, measured at 1 meter from building surfaces.

6. QUALITY ASSURANCE

The NES/IES Program Management Plan (document #82A8626) was implemented for the duration of the project. The elements of this plan include controlled procedures for performing all decommissioning activities, daily instrument performance checks, data review including routine surveys, radiation work permits, and the use of properly calibrated instrumentation.

7. DECOMMISSIONING OPERATIONS

7.1 Mobilization

NES personnel arrived at the Bausch & Lomb site on December 5, 1994 and set up an office and count room adjacent to the Batch Room. Material and equipment were transported from the Danbury office to the Bausch & Lomb site. NES personnel familiarized themselves with the project area by conducting a walk-through of the Glass Plant.

All NES personnel were qualified radiation workers in accordance with 10 CFR 19.12, and received a general safety briefing from the Site Supervisor.

7.2 Initial Conditions

During the decontamination and survey activities, the building was being prepared for demolition. Most of the useful equipment and material had been removed. All material and equipment still located within the building was considered scrap. Utilities such as electric, gas, phone, and water were still being supplied at the start of the decontamination activities. Access to the site was limited to personnel directly related to the demolition of the Glass Plant.

A large hole in the roof was located at the northern end of the Batch Room. Part of the floor area was directly exposed to snow and rain as a result. Heat was not available in the Batch Room.

7.2.1 Initial surveys

Baseline surveys were performed to determine background radioactivity levels, and proper posting requirements. Background dose rates were determined to be 5 μRem/hr. Five areas were identified by Bausch & Lomb for initial surveying

including: the Batch Room, R&D Area, Furnace Area, Storage Room, and the Process Line. These areas were selected based on Bausch & Lomb's understanding of the site operation. Based on operating history and prior survey results, the Batch Room was classified as an affected area, while the remaining four areas were classified as unaffected areas. The Batch Room was designated as a Radiologically Controlled Area (RCA), and "Radioactive Material" signs were posted at all entrances to the room.

Survey measurements for surface activity consisted of a combination of surface scans, direct (i.e., fixed plus removable) contamination measurements, and removable surface contamination measurements. The surface scan is used to identify the presence of elevated direct radiation that might indicate activity or hot spots. The surface scan was conducted for all nuclides potentially present, i.e., thorium isotopes and their associated daughters. Systematic measurements of direct and removable surface contamination were performed to quantify the levels of activity.

Minimum Detectable Activities (MDA's) were calculated for both the fixed contamination survey instrumentation and the smear counter. See Attachment 1 for MDA calculations and results.

Air sampling was performed in the Batch Room for each day of decontamination activities. See Attachment 1 for Minimum Detectable Count Rate (MDCR)/Minimum Detectable Concentration (MDC) calculations and air sample results.

Surface Scan

A 100% surface scan survey was performed for the floor and lower wall surfaces of affected areas. A 10% scan was performed for the floor and lower wall surfaces of unaffected areas. A ratemeter/scaler connected to a Geiger-Muller (GM) pancake probe was used to perform the surface scan for beta/gamma emitters and a ZnS detector was used to scan for alpha emitters. The surface scan was performed by keeping the detector as close to the surface as possible and moving the detector at a slow speed (i.e., speed did not exceed one detector width per second for alpha and beta/gamma radiations). Areas of elevated surface activity were noted by changes in the audible signal from the survey meter, rather than by observing fluctuations in the analog/digital meter reading.

Areas of elevated activity identified by the surface scan were marked on the surface with colored chalk by circling the elevated areas to establish boundaries. Direct measurements were taken to determine the extent of residual activity.

Scans of the Glass Plant unaffected areas led to the discovery of two areas with radioactivity above background. The first area was the R&D area, located in the southwest corner of the building. The radioactivity in this area was limited to steel trays containing a crystalline form of KNO_3. After the trays were transferred to the Batch Room, the R&D area was resurveyed as an unaffected area. The second area was the Furnace Area, located in the middle of the northern half of the Glass Plant. One of the furnaces had traces of radioactivity in the fire brick. The radioactivity in the firebrick was attributed to naturally occurring radioactive material (NORM) and not the result of licensed operations. Furthermore, the furnace area scan did not identify any areas greater than the release criteria. For this reason, the firebrick was left in place and the furnace area was surveyed as an unaffected area. The storage and process line were surveyed as unaffected areas and no residual activity above the release criteria was found.

Direct Measurements

For all building surfaces, i.e., floors, lower and upper walls, and ceilings, random measurement locations for each surface were collected. One 1 minute direct beta-gamma and one 1 minute direct alpha surface contamination reading were taken from areas with the highest elevated activity identified during the surface scan. The Ludlum 2220 meter and 44-9 GM pancake probe were used to perform the beta-gamma direct measurements, while the Ludlum 2220 meter and AC-3 alpha scintillation probe were used to perform the alpha direct measurements.

Removable Contamination Measurements

Smears for removable contamination were collected at random locations throughout the Glass Plant. The smears were obtained by wiping an area of approximately 100 cm^2 using a dry filter paper. Survey results indicate removable contamination levels below USNRC and state guidelines.

Dose Rate Measurements

Dose rate measurements were obtained using a Bicron MicroRem meter. The dose rates in the Glass Plant were <5 μRem/hr above background at all surveyed locations within the building.

Bulk Samples

Bulk samples were collected from the vacuum cleaner dust and the KNO_3 trays to determine the nature and extent of the contamination.

7.2.2 Initial survey results summary

The following tables summarize the results from the initial surveys that had indications of activity level greater than USNRC and state release criteria. See Attachment 1 for initial survey documents including layouts.

Batch Room

Table 2: Bird Cage

Location	Direct β-γ	Direct α	Removable β-γ, α
Platform	5,182	< 69	NA
Platform	8,347	< 69	NA
Platform	7,647	< 69	NA

Note: Activity results are in dpm/100 cm^2

Table 3: South Hood

Location	Direct β-γ	Direct α	Removable β-γ, α
Center Roof	17,600	2,430	NA
Right Roof	12,100	4,440	NA
Sifter Basket	19,700	1,050	< 32, < 8
Sifter Basket	30,900	1,590	< 32, < 8

Note: Activity results are in dpm/100 cm^2

Table 4: Middle Hood

Grid Number	Direct β-γ	Direct α	Removable β-γ, α
Right Exhaust	30,100	1,200	< 32, < 8
Right Roof	25,200	6,420	< 32, < 8
Right Wall	21,476	990	NA
Sifter Side	140,000	42,000	89, 52
Floor	4,200	3,810	< 32, < 8
Floor	9,604	2,250	< 32, < 8
Floor	23,156	2,010	< 32, 35
Floor	15,680	450	NA

Note: Activity results are in dpm/100 cm^2

Table 5: Bulk Sample Results

Sample Source	Type	Location	Results
Vacuum Cleaner	Dust, Chipped Concrete	Batch Room	55 pCi/g Th-232 35 pCi/g K-40
KNO3 Trays	Crystalline, powdered	Batch Room (Removed from R&D Area)	361 pCi/g K-40

7.3 Setup Radiologically Controlled Areas (RCAs)

The Batch Room was maintained as a radiologically controlled area (RCA) during the project. The entrance to the RCA was the northern sliding door. The western sliding door was roped off and posted. This door was kept shut during the project, and only used before and after decontamination activities. A 4'x4' hole in the western wall was roped and posted until it was nailed shut with a wood panel. Personnel were required to frisk out at the RCA entrance, and a waste container was available for potentially contaminated clothing and supplies.

7.4 Concrete Decontamination

This task required the issuance of a Radiation Work Permit (RWP) prior to task commencement. The RWP included worker protective clothing requirements, health physics technician (HP) job coverage and air sampling requirements during concrete decontamination operations.

The fixed floor contamination within the Batch Room was removed using a chipping hammer with a scabbling attachment. The scabbler worked by driving steel points into the surface of the concrete at very high speeds. Generated debris was collected by the vacuum cleaner during the scabbling process. Dust was controlled by wetting the surface to be scabbled and keeping the vacuum hose close to the scabbler during operation. A High Efficiency Particulate Air (HEPA) vacuum was used to collect any remaining debris on the floor.

The effectiveness of the decontamination was determined through the use of field survey instrumentation. Specifically, as the concrete was scabbled, the freshly exposed concrete surface was scanned for the presence of further contamination. Alpha probes (e.g., Eberline AC-3) were used for detection of thorium isotopes, while beta/gamma probes (e.g., Ludlum 44-9 GM pancake probes) allowed detection of K-40 or thorium daughters in the contaminated concrete. Any remaining "hot spots" were identified and further remediated to below release levels.

The scabbled concrete debris was placed in a disposal container (a B-25 strong tight container). Personnel were required to wear respiratory protection while emptying the vacuum cleaner in precaution of airborne contamination being generated. The collected dust and debris was carefully deposited into a bag, sealed and placed into a disposal container.

7.5 Other Decontamination

Other surfaces additional to concrete required decontamination. The bird cage had a contaminated, crusty substance which was loosened and vacuumed up. Contaminated wood along the southern wall was cut out with a reciprocating saw. Contaminated sheet metal from the south and middle hoods was cut out with a reciprocating saw. Contaminated ventilation from the middle hood was segmented with the reciprocating saw to accommodate the limited space of the B-25 box. The contaminated sifter basket from the south hood was removed from the sifter. The entire sifter from the middle hood was disassembled. All waste generated from these activities was disposed of into a B-25 strong tight box. The trays of KNO_3 were collected and disposed of separately in a 55 gallon drum.

These tasks also required the issuance of a Radiation Work Permit (RWP) prior to task commencement. The RWP included the worker protective clothing requirements, HP coverage and air sampling requirements.

Contamination surveys were performed as necessary outside the radiologically controlled areas. These surveys were conducted to verify that contamination had not spread from the RCA during decommissioning operations. These surveys aided in the substantiation that administrative and engineering controls implemented during decontamination operations were adequate. No contamination outside of the RCA was detected by the routine surveys.

7.6 Air Sampling

Air samples were collected over the course of the decommissioning project. Air samples with initial results near or exceeding 2E-13 μCi/ml for alpha emitters were recounted within 24 hours to allow for decay of short-lived naturally-occurring radionuclides. No long lived activity was detected. The air samples collected during decontamination activities were all less than the allowable derived air concentration for alpha emitters. Air sample results are contained in Attachment 1.

7.7 Final Release Survey

At the completion of decontamination efforts, a final release survey was performed in accordance with NUREG/CR-5849, "Manual for Conducting Radiological Surveys in Support of License Termination," 1992. The survey objective was the unrestricted release of the Glass Plant. Section 8 of this report contains survey methodology and results.

7.8 Preparation/Shipment of Waste

This task included packaging of the radioactive waste. Contaminated waste consisted of concrete, wood, sheet metal, protective clothing, decontamination material (i.e., HEPA filter, rags, etc.). The waste containers were surveyed and the results documented (see Attachment 1). Two representative samples of the waste have been sent to a Utah state approved laboratory to be analyzed for acceptance at the Envirocare facility. The containers are stored on-site until they are approved for final shipment to Envirocare of Utah Inc. All non-radioactive waste will remain on-site for disposal by Bausch & Lomb.

7.8.1 Waste characterization

Initial analysis of the two wastes generated (i.e. concrete removed and KNO_3) is as follows:

K-40	240 lbs x 361 pCi/g x 454 g/lb	=	3.94×10^7 pCi	(55 gallon drum)
Th-nat	1196 lbs x 50 pCi/g x 454 g/lb	=	2.71×10^7 pCi	(B-25 Box)
K-40	1196 lbs x 35 pCi/g x 454 g/lb	=	1.90×10^7 pCi	(B-25 Box)

For a total of:

27.1 μCi of Th-nat, and 19.0 μCi of K-40 in the B-25 Box (46.1 μCi total)
68.2 μCi of K-40 in the 55 gallon drum.

Both totals are below the exempt quantities in 12 NYCRR Part 38.41, Table 4. Thus, per 12 NYCRR Part 38.25 Section c.4.i, labeling of waste containers is not required. Furthermore, the quantity of K-40 in Bausch & Lomb's possession is within the allowable limits as established in 12 NYCRR Part 38, Table 1, Exemption 28.

The total specific activity of the thorium is determined using the following equation:

$$Curies/gram = \frac{(N)\ (1.873e-11)}{T_{1/2}} \qquad (1)$$

where,

$T_{1/2}$ = Half life (4.45×10^{17} seconds)
N = Number of atoms per gram (2.6×10^{21} atoms per gram)

For a total of 0.11 μCi/g of Th-232.

With a total of 27.1 μCi of Th-232 in the waste container, and a specific activity of 0.11 μCi/g, the total weight of Th-232 is 246.4 grams (8.8 ounces). This is below the 15 pounds of Th-232 allowed under 12 NYCRR Part 38, Table 3, item d. Similar calculations were performed for Th-228 resulting in an insignificant contribution to the total source material possessed by Bausch & Lomb.

7.9 Demobilization

All equipment was packed up for removal back to the Danbury office on December 15, 1994. The site was cleaned of all rubbish generated by the work activities. A site closeout meeting was held between NES and Bausch & Lomb to discuss the project and to transfer responsibility of open items to Bausch & Lomb (waste disposal).

8. FINAL RELEASE SURVEY

The survey procedures contained herein are consistent with the recommendations of draft NUREG/CR-5849, "Manual for Conducting Radiological Surveys in Support of License Termination."

8.1 Final Survey Approach

The initial site characterization served as a guide to effectively classify the Bausch & Lomb Glass Plant into affected and unaffected areas. Specifically, the affected area was taken as the area containing residual activity above USNRC and state release criteria, i.e., the Batch Room.

A survey unit was defined for the affected area according to the guidance presented in NUREG/CR-5849. The Batch Room constituted one survey unit (see Figure 1 for room location). A grid system was established within the room to facilitate the systematic selection of survey locations and to provide a mechanism for referencing a survey measurement to a specific location for possible further remediation.

The basic grid system consisted of dividing the floors and 2 meters up the lower walls into 1 meter grids. The upper walls and the ceilings were not gridded. Survey measurements performed on ungridded surfaces were referenced to a floor grid or to a prominent building feature.

The remaining areas (i.e., R&D Area, Furnace Area, Storage Room, and Process Line) were classified as unaffected areas and the initial survey served as the final release survey. Each area was defined as a survey unit for purposes of the survey. A minimum of 10% of the floor and lower walls were surveyed in each area. A minimum of thirty randomly selected spots from each area were surveyed for total and removable activity. Dose rate measurements were taken at 1 meter from the floor in all of the unaffected areas.

8.1.1 Surface scan

Initially, a 100% surface scan survey was performed for the floor and lower wall surfaces of affected areas and 10% for unaffected areas. A gas proportional floor monitor was used to initially survey the floor for elevated activity and hot spots. A ratemeter/scaler connected to a GM pancake probe was used to perform further scans for beta/gamma emitters and a ZnS detector was used to scan for alpha emitters.

Locations of areas of elevated activity identified by the surface scan were marked on the surface with chalk and documented.

8.1.2 Direct measurements

One direct beta-gamma and one direct alpha surface contamination reading was taken from the center of each floor and lower wall grid in affected areas and 30 random locations in unaffected areas. Each direct measurement was one minute in duration. The Ludlum 2220 rate meter/scaler and 44-9 GM pancake probe, were used to perform the beta-gamma direct measurements, while the Ludlum 2220 rate meter/scaler and AC-3 alpha scintillation probe were used to perform the alpha direct measurements.

Additional measurements were performed in the vicinity of direct measurements that indicated the presence of residual activity exceeding 60% of the guideline value (i.e., 3000 dpm/100 cm^2 for beta/gamma emitters and 600 dpm/100 cm^2 for alpha emitters). An estimate of the elevated activity area was performed and recorded. Five additional measurements were performed at random locations within the grid. The average residual activity value reported on the survey form was calculated by:

$$x_m = [\frac{\Sigma x_i}{n}] \qquad (2)$$

where,

x_m = mean residual activity for the 1 m^2 grid,
x_i = residual activity of each direct measurement,
n = number of residual activity measurements (= 5).

The elevated residual activity area was remediated if the mean residual activity for the grid exceeded the guideline value.

For the ceiling of affected areas, 32 points were surveyed. The points correlated to floor grids. At each measurement location a scan of the immediate area was performed to identify the presence of any elevated residual activity, followed by a direct measurement. No contamination was identified in the ceiling area.

8.1.3 Removable contamination measurements

A smear for removable contamination was collected at each location of direct surface activity measurement. Each smear was counted by a Ludlum 2220 rate meter/scaler with 44-9 GM pancake probe for beta-gamma measurements, a Ludlum 2220 rate meter/scaler with AC-3 alpha scintillation probe for alpha measurements, or a Canberra automated smear counter. The results of the removable surface contamination survey were documented on the appropriate survey form. Refer to the respective room survey documentation found in Attachment 1 for removable contamination survey results.

8.1.4 Dose rate measurements

Dose rate measurements were obtained at 1 meter from floor and lower wall surfaces. These measurements were performed at a frequency of one (1) systematic measurement per grid. The Bicron MicroRem meter was used to obtain the dose rate measurements.

Dose rate measurements were documented and are included with the survey documentation contained in Attachment 1. Dose rates from all areas were within background levels and ranged from 4 to 9 μRem/hr.

8.2 Survey Instrumentation

The following table lists the instrumentation used during the final release survey, its primary use, calibration date, calibration due date and serial number. Calibration data sheets are also included in Attachment 1.

Table 6: Final Survey Instrumentation

Instrument	Use	Calibration Date	Calibration Due Date	Serial Number Meter/Probe	Efficiency
Ludlum 2220 ratemeter/scaler w/AC-3 probe	Alpha direct measurements and scan surveys	10/17/94	10/17/95	50067 / 712582	0.0667
Ludlum 2220 ratemeter/scaler w/44-9 probe	Beta-gamma direct measurements and scan surveys	10/17/94	10/17/95	52836 / PRO68918	0.239
Ludlum 2220 ratemeter/scaler w/44-9 probe	Beta-gamma direct measurements and scan surveys	10/17/94	10/17/95	50061 / PRO66761	0.238
Ludlum 2220 ratemeter/scaler w/43-37 probe	Floor monitor for beta-gamma measurements	8/20/94	8/20/95	50062 / PRO68422	0.103
Canberra Series 20 MCA w/HPGe detector	Gamma spectroscopy sample analysis	As Needed	As Needed	989997	NA
Canberra 2504	Alpha/Beta/Gamma Smear Counter	As Needed	As Needed	11924461	0.342 α 0.392 $\beta\gamma$
Bicron Micro-Rem	Dose rate surveys	10/14/94	10/14/95	B218L	NA

8.2.1 MDA's

Minimum detectable activities (MDA's) were calculated for both the hand-held survey instrumentation (e.g., Ludlum 2220 with the 44-9 GM pancake probe and Ludlum 2220 meter with the AC-3 alpha scintillation probe). The MDA was calculated by the following equation (reference 4):

$$MDA = \frac{\frac{2.71}{T_s} + 3.29\sqrt{\frac{R_b}{T_b} + \frac{R_b}{T_s}}}{(efficiency)\left(\frac{probe\ area}{100\ cm^2}\right)}, \quad (3)$$

where,

R_b = Background counting rate (cpm),
T_b = Background count time (min), and
T_s = Sample count time (min).

The MDA for the Ludlum 2220 and 44-9 GM pancake probe was calculated in the same units as the fixed contamination results (i.e., dpm/100 cm^2). For MDA results see attachment 1.

8.2.2 Interpretation of survey results

Direct contamination readings were converted to dpm/100 cm^2 using the following formula (probe area for the Ludlum 44-9 GM pancake probe was 15 cm^2):

$$dpm/100\ cm^2 = \frac{gross\ cpm - background\ cpm}{(efficiency)\ (\frac{probe\ area}{100\ cm^2})} \quad (4)$$

The average background count rate for the direct survey instrumentation was determined by a series of ten 1 minute counts. Each direct measurement of fixed contamination was 1 minute in duration. If a direct measurement resulted in a value less than the calculated minimum detectable activity for the survey instrumentation, this was recorded as less than the value for the MDA (i.e, if the MDA for beta-gamma activity was 940, a value measured below MDA was recorded as < 940).

8.3 Summary of Results

The survey results presented here are a summary of the actual survey data presented in Attachment 1.

8.3.1 Unaffected areas

The following table provides a summary of the survey data from the final release survey of the unaffected areas of the Glass Plant (activity levels below MDA are reported as less than the given value for that MDA):

Table 7: Summary of Results From Unaffected Area Surveys

Location	Activity (dpm/100cm^2)				Dose (μRem/hour)
	Direct		Removable		
	$\beta\gamma$	α	$\beta\gamma$	α	
R&D Area	<1360-3360	<69	<940	<69	4-5
Process Line	<1360	<69	<940	<69	5-6
Storage Room	<1360-2520	<69	<940	<69	4-6
Furnace Area	<1366-3420	<69-150	<940	<69	4-5

Table 7a: MDA's for Unaffected Area Surveys

Location	Activity (dpm/100cm^2)			
	Direct		Removable	
	$\beta\gamma$	α	$\beta\gamma$	α
R&D Area	1360	69	940	69
Process Line	1360	69	940	69
Storage Room	1360	69	940	69
Furnace Area	1360	69	940	69

Table 7b: True Mean Activity Upper Limit at the 95% Confidence Level for the Unaffected Area Survey Units

Location	Activity (dpm/100cm^2)											
	Direct						Removable					
	$\beta\gamma$			α			$\beta\gamma$			α		
	n_s	x_{ave}	μ_α	n_s	x_{ave}	μ_α	n_s	x_{ave}	μ_α	n_s	x_{ave}	μ_α
R&D Area	30	1504	1648	30	69	69	30	940	940	30	69	69
Process Line	30	1360	1360	30	69	69	30	940	940	30	69	69
Storage Room	30	1409	1477	30	69	69	30	940	940	30	69	69
Furnace Area	30	1657	1854	30	69	69	30	940	940	30	69	69

Where: n_s = number of measurements within a survey unit
x_{ave} = calculated mean for a survey unit
μ_α = true mean activity upper limit at the 95% confidence level

Table 7c: Summary of Dose Rate Measurements for Unaffected Areas

Location	Dose Rate (μRem/hr)			
	n_s	x_{ave}	s_x	μ_α
R&D Area	30	4.8	0.4	4.9
Process Line	30	5.2	0.4	5.3
Storage Room	30	5.0	0.5	5.2
Furnace Area	30	4.9	0.3	5.0

Where: n_s = number of measurements within a survey unit
x_{ave} = calculated mean for a survey unit
s_x = standard deviation
μ_α = true mean activity upper limit at the 95% confidence level

8.3.2 Affected Area

The following table provides a summary of the survey data from the final release survey of the Batch Room (activity levels below MDA are reported as less than the given value for that MDA):

Table 8: Summary of Survey Results From Affected Area (Batch Room)

Location	Activity (dpm/100cm²)				Dose (μRem/hour)
	Direct		Removable		
	βγ	α	βγ	α	
North Wall	<1366	<69	<940	<69	5-6
South Wall	<1366	<69-276	<940	<69	6-8
West Wall	<1366	<69	<940	<69	5-6
East Wall	<1366	<69-120	<940	<69	5-9
Floor	<1366-3506	<69-600	<940	<69	5-8
Overheads	<1366	<69	<940	<69	4

Table 8a: MDA's for Affected Area Surveys

Location	Activity (dpm/100cm²)			
	Direct		Removable	
	βγ	α	βγ	α
North Wall	1366	69	940	69
South Wall	1366	69	940	69
West Wall	1366	69	940	69
East Wall	1366	69	940	69
Floor	1366	69	940	69
Overheads	1366	69	940	69

Table 8b: True Mean Activity Upper Limit at the 95% Confidence Level for the Affected Area Survey Units

Location	Activity (dpm/100cm^2)											
	Direct						Removable					
	$\beta\gamma$			α			$\beta\gamma$			α		
	n_s	x_{ave}	μ_α	n_s	x_{ave}	μ_α	n_s	x_{ave}	μ_α	n_s	x_{ave}	μ_α
North Wall	18	1366	1366	18	69	69	18	940	940	18	69	69
South Wall	18	1366	1366	18	86	107	18	940	940	18	69	69
West Wall	42	1366	1366	42	69	69	42	940	940	42	69	69
East Wall	42	1366	1366	42	70	72	42	940	940	42	69	69
Floor	189	1451	1491	189	104	116	189	940	940	189	69	69
Overheads	32	1366	1366	32	69	69	32	940	940	32	69	69

Where: n_s = number of measurements within a survey unit
x_{ave} = calculated mean for a survey unit
μ_α = true mean activity upper limit at the 95% confidence level

Table 8c: Summary of Dose Rate Measurements for Affected Area

Location	Dose Rate (μRem/hr)			
	n_s	x_{ave}	s_x	μ_α
North Wall	18	5.2	0.4	5.3
South Wall	18	6.6	0.6	6.9
West Wall	42	5.3	0.5	5.4
East Wall	42	7.2	1.2	7.6
Floor	189	5.8	0.8	5.9
Overheads	32	4.0	0.0	4.0

Where: n_s = number of measurements within a survey unit
x_{ave} = calculated mean for a survey unit
s_x = standard deviation
μ_α = true mean activity upper limit at the 95% confidence level

9. REFERENCES

1. USNRC "Guidelines for Decontamination of Facilities and Equipment Prior to Release for Unrestricted Use or Termination of Licenses for Byproduct, Source or Special Nuclear Material," May 1987.

2. NUREG/CR-5849. "Manual for Conducting Radiological Surveys in Support of License Termination," 1992.

3. NES Procedure 82A8006, "Radiation Worker Handbook and Training Manual."

4. Strom, Daniel J. And Stansbury, Paul S.; "Minimum Detectable Activity When Background is Counted Longer than the Sample," Health Physics 63(3):360-361, 1992.

5. New York Department of Labor Industrial Code Rule 38, "Ionizing Radiation Protection," June 29, 1994.17

Attachment 1

Survey Sheets

ATTACHMENT CONTENTS

Section 1 - Initial Surveys

- Bird Cage
- South Hood
- South Hood Sifter
- Middle Hood

Section 2 - Unaffected Area Surveys

- R&D Area
- Process Line
- Storage Room
- Furnace Area

Section 3 - Affected Area Surveys

- Batch Room North Wall
- Batch Room South Wall
- Batch Room West Wall
- Batch Room East Wall
- Batch Room Floor
- Batch Room Overheads
- Batch Room Miscellaneous Equipment
  - Hood #1
  - Hood #2
  - Mixer #1
  - Mixer #2
- Batch Room Scale
- Batch Room Hopper
- Batch Room Bird Cage

Section 4 - Batch Samples

- Analysis of 55 Gallon Drum and B-25 Box Contents

Section 5 - Calibration Documents

Section 6 - Air Sample Results

Section 7 - Waste Container Surveys

Section 1

Initial Surveys

Bird Cage
South Hood
South Hood Sifter
Middle Hood

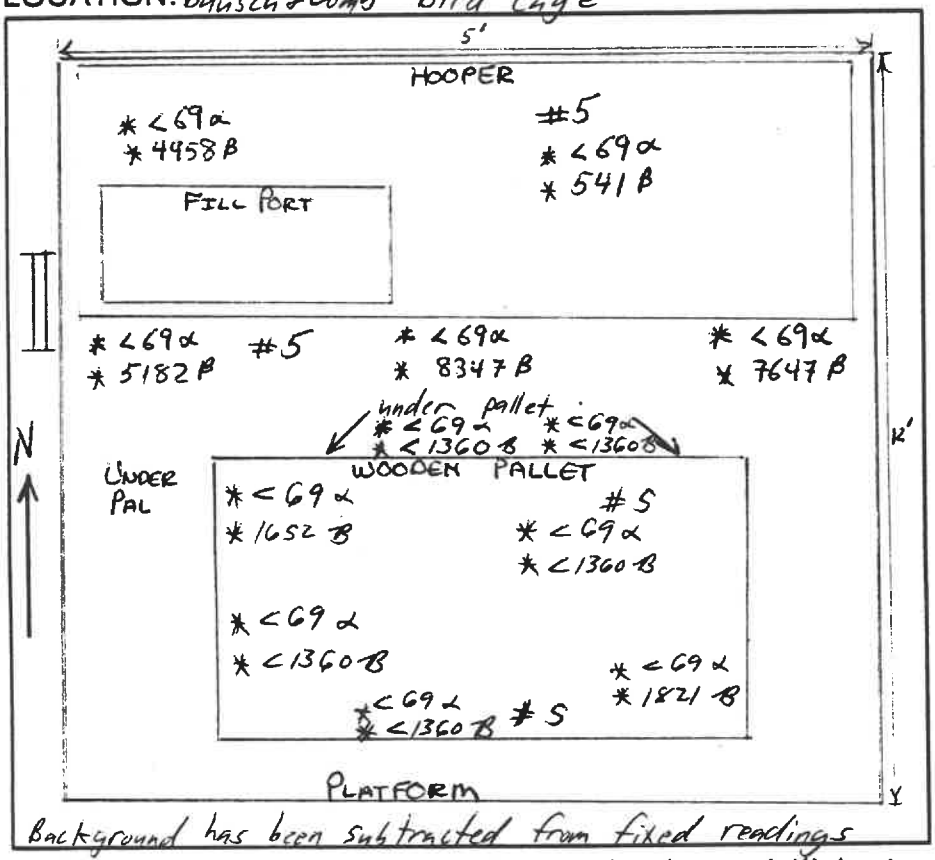
SURVEYOR Brandon Shaw DATE 12-7-94

REVIEWER D. L. Warner TIME 0930

SURVEY METERS

MODEL Ludlum 2220	MODEL Ludlum 2220	MODEL Bicron
SERIAL # 52836	SERIAL # 50067	SERIAL # BZ18L
CAL DUE 10-17-95	CAL DUE 10-17-95	CAL DUE 10-14-95
EFFICIENCY 0.239	EFFICIENCY 0.0667	EFFICIENCY NA
TYPE 44-9	TYPE AC-3	TYPE MicroRem
BKG 98 cpm	BKG 0 cpm	BKG 5 mRem/hr
MDA 1360 dpm/100cm²	MDA 69 dpm/100 cm²	MDA NA

LOCATION: Bausch & Lomb Bird Cage



Background has been subtracted from fixed readings

SMEAR #	dpm/100 cm² βγ	dpm/100 cm² α
No smears were taken. Surface is a salt coated surface. Any activity would cause the surface to become removable.		
	N A	

NOTE: Smear results in dpm/100 cm² unless otherwise noted. (1) denotes smear location. An * followed by a number in dpm (i.e., * 100 dpm) denotes direct probe readings in dpm/100 cm². # denotes dose rates in ~~mR/hr~~ mRem/hr @ 1m

PURPOSE: Initial Survey

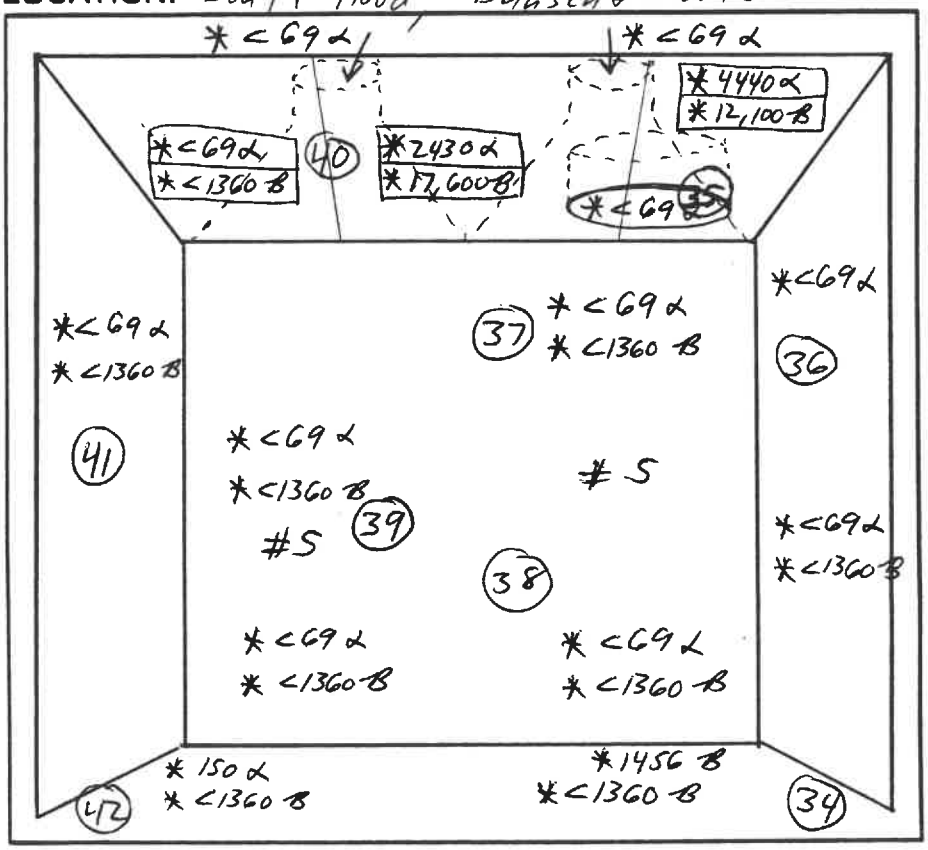
SURVEYOR D. L. Vann DATE 12/7/94

REVIEWER B. Smith TIME 1030

SURVEY METERS

MODEL L-2220	MODEL L-2220	MODEL Bicron
SERIAL # 52836	SERIAL # 50067	SERIAL # B218L
CAL DUE 10/17/95	CAL DUE 10/17/95	CAL DUE 10/14/95
EFFICIENCY 0.239	EFFICIENCY 0.0667	EFFICIENCY NA
TYPE 44-9	TYPE AC-3	TYPE Micro Rem
BKG 98	BKG 0	BKG 5 mRem/hr
MDA 1360 dpm/100cm²	MDA 69 dpm/100 cm²	MDA NA

LOCATION: South Hood, Bausch & Lomb



NOTE: Smear results in dpm/100 cm² unless otherwise noted. (1) denotes smear location. An * followed by a number in dpm (i.e., * 100 dpm) denotes direct probe readings in dpm/100 cm². # denotes dose rates in ~~mRem~~ μRem/hr @ 1m. ▭ indicates survey performed on roof.

PURPOSE: Initial Survey

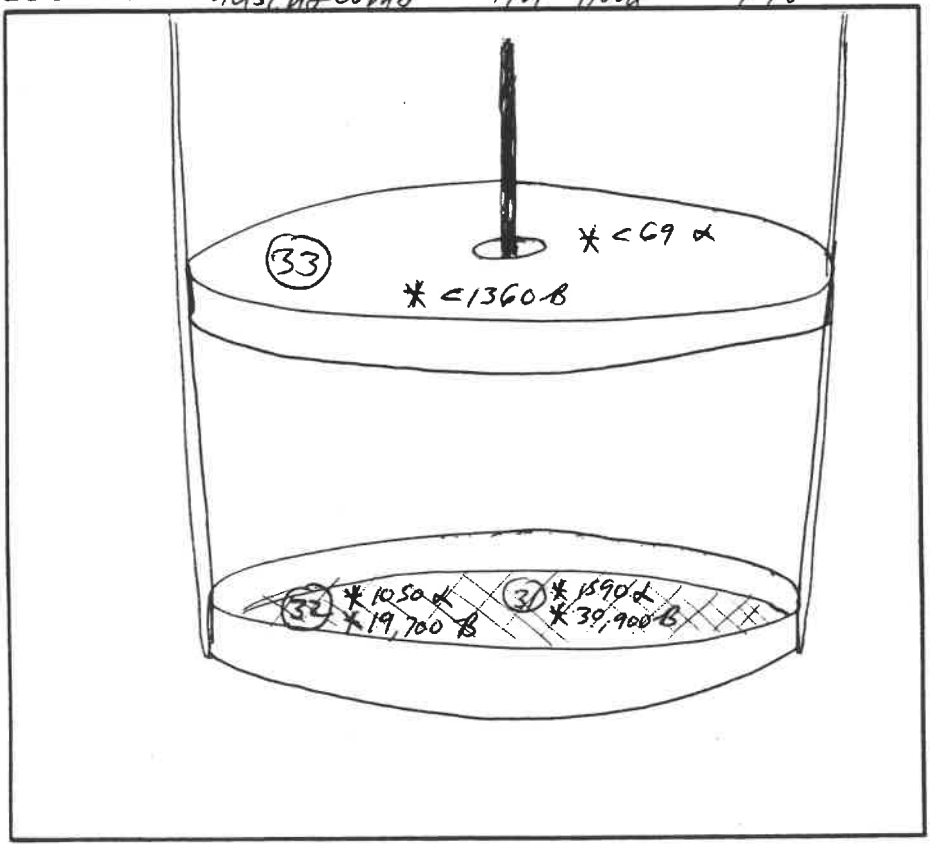
SMEAR #	dpm/100 cm² βγ	dpm/100 cm² α
34	< 32	< 8
35	< 32	< 8
36	< 32	< 8
37	< 32	< 8
38	< 32	< 8
39	< 32	< 8
40	< 32	< 8
41	< 32	< 8
42	< 32	< 8
Surveys performed on Eberline		CAL DUE 1-1-95
α eff.	34.20	%
β/γ eff.	39.40	%
α Bkg	0 cpm	
β/γ Bkg	8 cpm	
α MDA	8 dpm	/100 cm²
β/γ MDA	32 dpm	/100 cm²
	N A	

SURVEYOR D. L. Vann DATE 12/7/94
REVIEWER B. Dealon TIME 0930

SURVEY METERS

MODEL L-2220	MODEL L-2220	MODEL
SERIAL # 52836	SERIAL # 50067	SERIAL #
CAL DUE 10/17/95	CAL DUE 10/17/95	CAL DUE
EFFICIENCY 0.239	EFFICIENCY 0.0667	EFFICIENCY
TYPE 44-9	TYPE Ac-3	TYPE N A
BKG 98 cpm	BKG 0 cpm	BKG
MDA 1360 dpm/100cm²	MDA 69 dpm/100cm²	MDA

LOCATION: Bausch+Lomb South Hood Sifter



SMEAR #	dpm/100 cm² βγ	α
31	< 32	< 8
32	< 32	< 8
33	< 32	< 8
Surveys performed on Canberra		
α eff.	34.20	%
β eff.	39.40	%
α bkg	0 cpm	
β bkg	8 cpm	
α MDA	8 dpm/100cm²	
β MDA	32 dpm/100cm²	
	N A	

NOTE: Smear results in dpm/100 cm² unless otherwise noted. (1) denotes smear location. An * followed by a number in dpm (i.e., * 100 dpm) denotes direct probe readings in dpm/100 cm². # denotes dose rates in mR/hr.

PURPOSE: Initial Survey

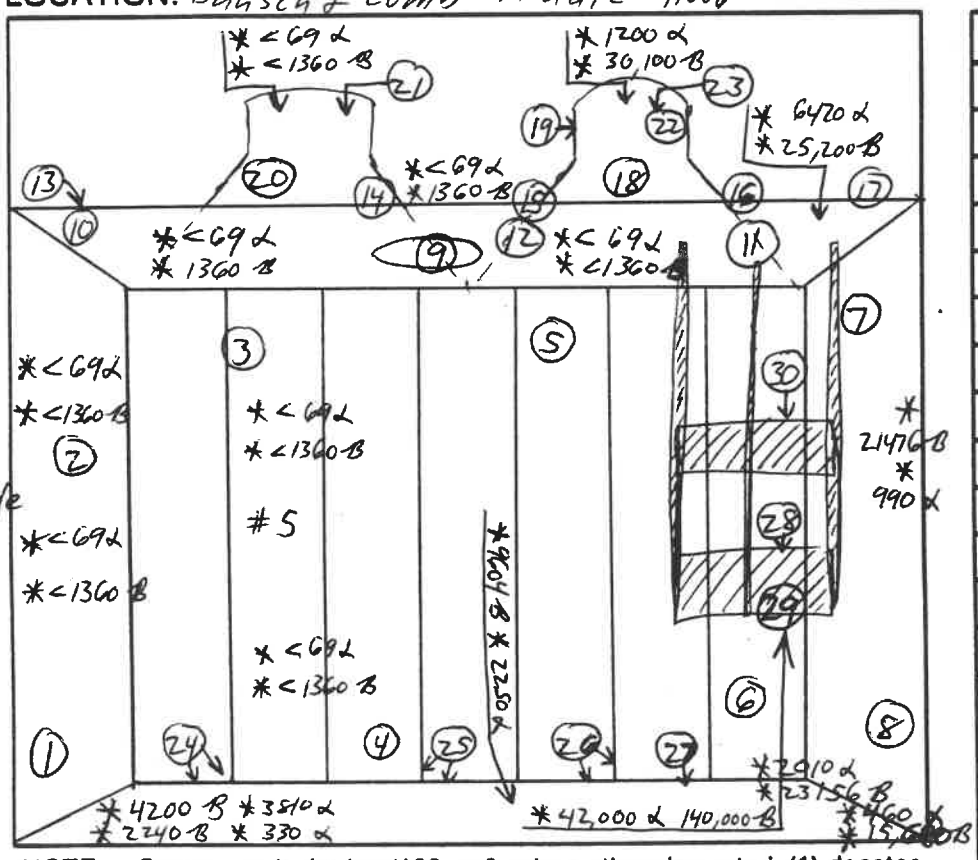
SURVEYOR D. L. Varns for Kevin Graczyk DATE 12-7-94

REVIEWER B Dreier TIME 1125

SURVEY METERS

MODEL Ludlum 2220	MODEL Ludlum 2220	MODEL Bicron
SERIAL # 52836	SERIAL # 50067	SERIAL # B218L
CAL DUE 10/17/95	CAL DUE 10/17/95	CAL DUE 10/14/95
EFFICIENCY 0.239	EFFICIENCY 0.0667	EFFICIENCY NA
TYPE 44-9	TYPE AC-3	TYPE Micro Rem
BKG 98 cpm	BKG 0 cpm	BKG 5 mRem/hr
MDA 1360 dpm/100cm^2	MDA 69 dpm/100cm^2	MDA NA

LOCATION: Bausch + Lomb middle Hood



Smears 10, 11 & 12 on underside of hood. 3-17 on top side of hood.

SMEAR #	dpm/100 cm^2 βγ	dpm/100 cm^2 α
1	< 32	11
2	< 32	9
3	< 32	< 8
4	< 32	< 8
5	< 32	< 8
6	< 32	< 8
7	< 32	< 8
8	< 32	26
9	< 32	< 8
10	< 32	14
11	< 32	< 8
12	< 32	< 8
13	< 32	< 8
14	< 32	< 8
15	< 32	< 8
16	< 32	49
17	< 32	< 8
18	< 32	< 8
19	< 32	< 8
20	< 32	< 8

NOTE: Smear results in dpm/100 cm^2 unless otherwise noted. (1) denotes smear location. An * followed by a number in dpm (i.e., * 100 dpm) denotes direct probe readings in dpm/100 cm^2. # denotes dose rates in ~~mR/hr~~ mRem/hr @ 1m

PURPOSE: Initial Survey

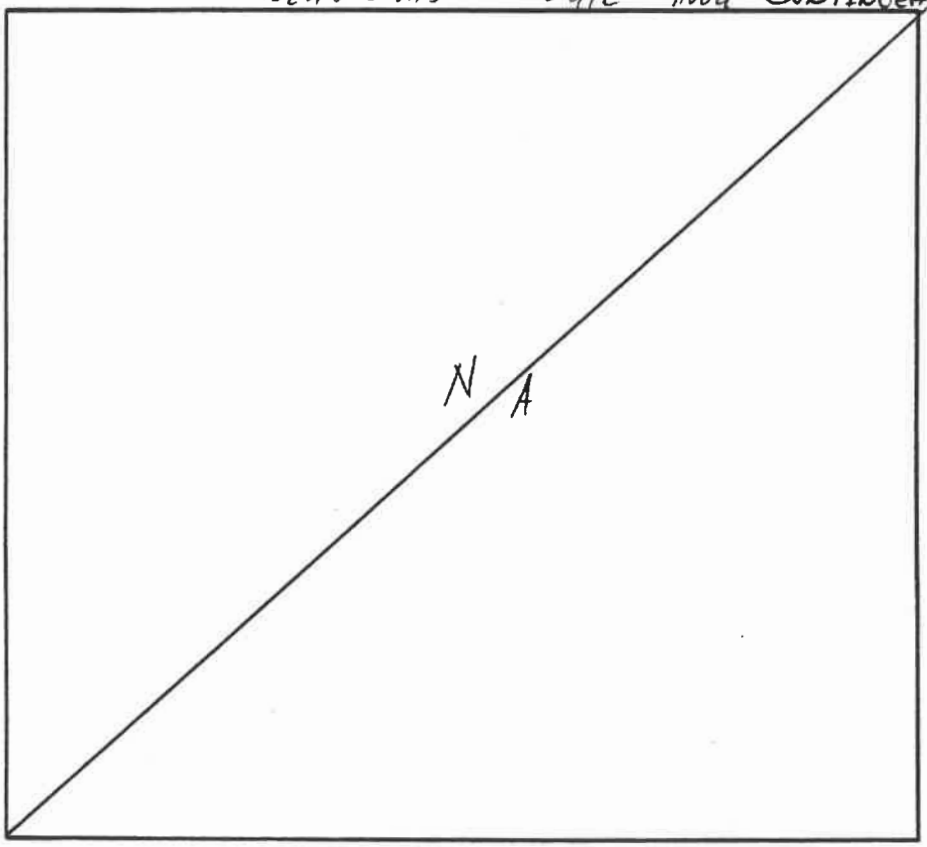
SURVEYOR D.L. Vann for Kevin Graczyk DATE 12-7-94

REVIEWER _____ TIME 1125

SURVEY METERS

MODEL Lud/um 2220	MODEL Lud/um 2220	MODEL Bicron
SERIAL # 52836	SERIAL # 50067	SERIAL # B2/8L
CAL DUE 10/17/95	CAL DUE 10/17/95	CAL DUE 10/14/95
EFFICIENCY 0.239	EFFICIENCY 0.0667	EFFICIENCY NA
TYPE 44-9	TYPE AC-3	TYPE Micro Rem
BKG 98 cpm	BKG 0 cpm	BKG 5mRem/hr
MDA 1360 dpm/100cm²	MDA 69 dpm/100 cm²	MDA NA

LOCATION: Bausch + Lomb middle Hood CONTINUEATION



SMEAR #	dpm/100 cm² βγ	dpm/100 cm² α
21	< 32	< 8
22	< 32	< 8
23	< 32	9
24	< 32	< 8
25	< 32	< 8
26	51	43
27	< 32	35
28	< 32	29
29	89	52
30	< 32	9
Smear Survey counted		
on Canberra II	11924461	
α eff.	34.20	%
α Bkg.	0 cpm	CAL DUE 1-1-95
β eff.	39.40	%
β Bkg	8 cpm	
α MDA	8 dpm/100 cm²	
β MDA	32 dpm/100 cm²	
	A	
	N	

NOTE: Smear results in dpm/100 cm² unless otherwise noted. (1) denotes smear location. An * followed by a number in dpm (i.e., * 100 dpm) denotes direct probe readings in dpm/100 cm². # denotes dose rates in mR/hr.

PURPOSE: Initial Survey

MDA CALCULATION SHEET

METER 2220 w/44-9 SERIAL #: 52836

TS: 1 TB: 1 RB: 98cpm EFF: 0.239 PROBE SIZE: 15 cm²

$$MDA = \frac{2.71}{1} + 3.29\left(\frac{98}{1} + \frac{98}{1}\right)^{1/2}$$

0.239 (15 / 100 cm2)

MDA = 1360 dpm/100 cm²

METER 2220 w/AC-3 SERIAL #: 50067

TS: 1 TB: 1 RB: 0cpm EFF: 0.0667 PROBE SIZE: 59 cm²

$$MDA = \frac{2.71}{1} + 3.29\left(\frac{0}{1} + \frac{0}{1}\right)^{1/2}$$

0.0667 (59 / 100 cm2)

MDA = 69 dpm/100 cm²

METER CANBERRA SERIAL #: 11924461

TS: 1 TB: 10 RB: 0cpm EFF: 0.342 PROBE SIZE: N/A

$$MDA = \frac{2.71}{1} + 3.29\left(\frac{0}{1} + \frac{0}{10}\right)^{1/2}$$

0.342 (N/A / 100 cm2)

α MDA = 8 dpm/100 cm²

METER CANBERRA SERIAL #: 11924461

TS: 1 TB: 10 RB: 8cpm EFF: 0.392 PROBE SIZE: N/A

$$MDA = \frac{2.71}{1} + 3.29\left(\frac{8}{1} + \frac{8}{10}\right)^{1/2}$$

0.392 (N/A / 100 cm2)

β MDA = 32 dpm/100 cm²

Technician: Brandon Gruber Date: 12-7-94

Reviewed by: D. L. Vann Date: 12-7-94

Section 2

Unaffected Area Surveys

R&D Area
Process Line
Storage Room
Furnace Area

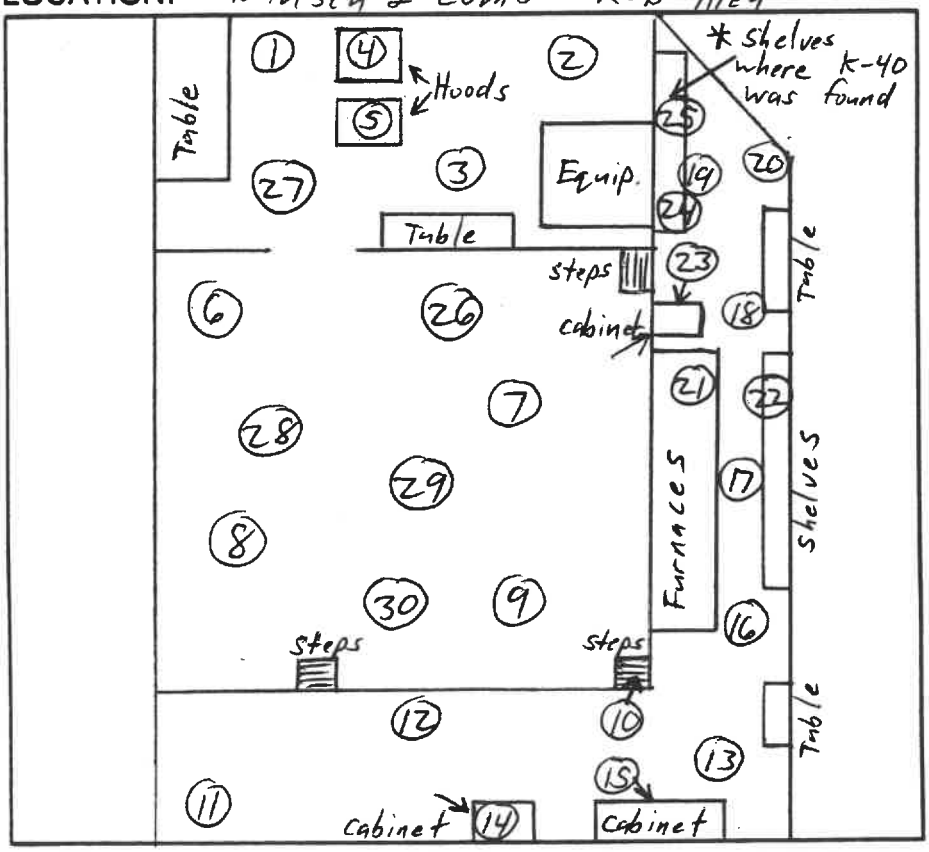
SURVEYOR D.L. Vann for Kevin Graczyk DATE 12/7/94

REVIEWER B Burke TIME 1415

SURVEY METERS

MODEL Ludlum 2220	MODEL Ludlum 2220	MODEL Bicron
SERIAL # 52836	SERIAL # 50067	SERIAL # B 2181
CAL DUE 10/17/95	CAL DUE 10/17/95	CAL DUE 10/14/95
EFFICIENCY 0.239	EFFICIENCY 0.0667	EFFICIENCY NA
TYPE 44-9	TYPE AC-3	TYPE Micro Rem
BKG 98 cpm	BKG 0 cpm	BKG 5 mRem/hr
MDA 1360 dpm/100cm²	MDA 69 dpm/100cm²	MDA NA

LOCATION: Bausch & Lomb R&D Area



SMEAR #	dpm/100 cm² βγ	dpm/100 cm² α
See	Attached	
	N	
	A	

NOTE: Smear results in dpm/100 cm² unless otherwise noted. (1) denotes smear location. An * followed by a number in dpm (i.e., * 100 dpm) denotes direct probe readings in dpm/100 cm². # denotes dose rates in mR/hr.

PURPOSE: Unaffected Area Release Survey

* KNO_3 containing K-40 was removed from the area and brought to the batch room.

REMOVABLE CONTAMINATION

DATE: 12/7/94 LOCATION: Bausch & Lomb R&D Area

COUNTER: Ludlum 2220 S# 50067 (Model / Number) EFFICIENCY: 0.0667 (Alpha) N/A (Beta/Gamma)

LOCATION	DPM/100cm² βγ	DPM/100cm² α	LOCATION	DPM/100cm² βγ	DPM/100cm² α	LOCATION	DPM/100cm² βγ	DPM/100cm² α
1		< 69	21		< 69			
2		< 69	22		< 69			
3		< 69	23		< 69			
4		< 69	24		< 69			
5		< 69	25		< 69			
6		< 69	26	N/A	< 69			
7		< 69	27		< 69			
8		< 69	28		< 69			
9		< 69	29		< 69			
10		< 69	30		< 69			
11	N/A	< 69					N/A	
12		< 69						
13		< 69						
14		< 69						
15		< 69		N/A				
16		< 69						
17		< 69						
18		< 69						
19		< 69						
20		< 69						

ALPHA BKG COUNT RATE: 0 cpm

BETA/GAMMA BKG COUNT RATE: NA

α MDA (dpm/100cm²) 69

βγ MDA (dpm/100cm²) NA

SURVEYOR D.L. Vann for Kevin Graczyk

SUPERVISOR [signature]

REMOVABLE CONTAMINATION

DATE: 12-7-94 LOCATION: Bausch + Lomb R + D

COUNTER: Ludlum 2220 (Model) ~~53536~~ 50061 DLU 1-2-95 (Number) EFFICIENCY: N/A (Alpha) ~~0,238~~ 0,239 DLU 1-2-95 (Beta/Gamma)

LOCATION	DPM/100cm² βγ	DPM/100cm² α	LOCATION	DPM/100cm² βγ	DPM/100cm² α	LOCATION	DPM/100cm² βγ	DPM/100cm² α
1	< 940		21	< 940				
2	< 940		22	< 940				
3	< 940		23	< 940				
4	< 940		24	< 940				
5	< 940		25	< 940	N			
6	< 940		26	< 940	A			
7	< 940		27	< 940				
8	< 940		28	< 940				
9	< 940		29	< 940				
10	< 940	N	30	< 940			N	
11	< 940	A					A	
12	< 940							
13	< 940							
14	< 940							
15	< 940			N				
16	< 940			A				
17	< 940							
18	< 940							
19	< 940							
20	< 940							

ALPHA BKG COUNT RATE: N/A

BETA/GAMMA BKG COUNT RATE: 44 cpm

α MDA (dpm/100cm²) N/A

βγ MDA (dpm/100cm²) 940

SURVEYOR P. L. Vigna

SUPERVISOR Brenda Lee

AVERAGE CONTAMINATION SURVEY RESULTS

DATE: 12/7/94 LOCATION: Bausch & Lomb R&D

INSTRUMENT: Ludlum 2220 S# 50067 PROBE: AC-3 EFF: 0.0667
MODEL NUMBER MODEL

GRID NUMBER	dpm/100cm2	GRID NUMBER	dpm/100cm2
1	< ~~69~~ 69 BLG 1-13-15	20	< 69
2	< 69	21	< 69
3	< 69	22	< 69
4	< 69	23	< 69
5	< 69	24	< 69
6	< 69	25	< 69
7	< 69	26	< 69
8	< 69	27	< 69
9	< 69	28	< 69
10	< 69	29	< 69
11	< 69	30	< 69
12	< 69		
13	< 69		
14	< 69		
15	< 69	N	
16	< 69	A	
17	< 69		
18	< 69		
19	< 69		

Average Background counts per minute 0 cpm

MDA (dpm/100cm 2) 69

*BASED ON AVERAGE OF 5 DIRECT MEASUREMENTS
(INITIAL DIRECT MEASUREMENT WAS GREATER THAN 60% OF GUIDELINE VALUE)

$$\frac{\text{dpm}}{100\text{cm}^2} = \frac{(\text{gross count rate}) - (\text{background count rate})}{(\text{efficiency})\ \frac{(\text{probe area})}{100\text{cm}^2}}$$

SURVEYOR D. L. Vinn for Kevin Graczyk

SUPERVISOR B Dale

AVERAGE CONTAMINATION SURVEY RESULTS

DATE: 12/7/94 LOCATION: Bausch & Lomb R&D Area

INSTRUMENT: Ludlum 2220 S# 52836 (MODEL / NUMBER) PROBE: 44-9 (MODEL) EFF: 0.239

GRID NUMBER	dpm/100cm2	GRID NUMBER	dpm/100cm2
1	< 1360	20	< 1360
2	2800	21	< 1360
3	< 1360	22	< 1360
4	< 1360	23	3360
5	< 1360	24	< 1360
6	< 1360	25	< 1360
7	< 1360	26	< 1360
8	< 1360	27	< 1360
9	< 1360	28	< 1360
10	< 1360	29	< 1360
11	< 1360	30	< 1360
12	< 1360		
13	< 1360		
14	< 1360		
15	< 1360		
16	< 1360		
17	< 1360		
18	< 1360		
19	2240		

N

A

Average Background counts per minute 98

MDA (dpm/100cm 2) 1360

*BASED ON AVERAGE OF 5 DIRECT MEASUREMENTS
(INITIAL DIRECT MEASUREMENT WAS GREATER THAN 60% OF GUIDELINE VALUE)

$$\frac{\text{dpm}}{100\text{cm}^2} = \frac{(\text{gross count rate}) - (\text{background count rate})}{(\text{efficiency})\ \frac{(\text{probe area})}{100\text{cm}^2}}$$

SURVEYOR D. L. Vann for K. Gracik

SUPERVISOR B. Gracik

EXPOSURE RATE SURVEY RESULTS

DATE: 12-7-94 LOCATION: Bausch & Lomb R&D AREA BLG 1-13-95

INSTRUMENT: Bicron B2181 CAL DUE: ~~10-14-95~~ 10-14-95

GRID NUMBER	EXPOSURE RATE µR/h 1cm	1m	GRID NUMBER	EXPOSURE RATE µR/h 1cm	1m
1		5 uR/hr	18		5 uR/hr
2		5 uR/hr	19		5 uR/hr
3		5 uR/hr	20		5 uR/hr
4		5 uR/hr	21		5 uR/hr
5		5 uR/hr	22		5 uR/hr
6		4 uR/hr	23		5 uR/hr
7		4 uR/hr	24	N/A	5 uR/hr
8		4 uR/hr	25		5 uR/hr
9	N/A	4 uR/hr	26		5 uR/hr
10		5 uR/hr	27		5 uR/hr
11		5 uR/hr	28		4 uR/hr
12		5 uR/hr	29		4 uR/hr
13		5 uR/hr	30		4 uR/hr
14		5 uR/hr			
15		5 uR/hr	N		
16		5 uR/hr		A	
17		5 uR/hr			

MEASUREMENTS TAKEN AT 1cm AND/OR 1m ABOVE THE FLOOR.

BKG: 5 uR/hr

SURVEYOR Kim R. Bruch

SUPERVISOR Brenda Lutz

MDA CALCULATION SHEET

METER 2220 w/44-9 SERIAL #: 52836

TS: 1 TB: 1 RB: 98 cpm EFF: 0.239 PROBE SIZE: 15 cm²

$$MDA = \frac{2.71/1 + 3.29\left(\frac{98}{1} + \frac{98}{1}\right)^{1/2}}{0.239 \quad (15 / 100\ cm2)}$$

MDA = 1360 dpm/100 cm²

METER 2220 w/AC-3 SERIAL #: 50067

TS: 1 TB: 1 RB: 0 cpm EFF: 0.0667 PROBE SIZE: 59 cm²

$$MDA = \frac{2.71/1 + 3.29\left(\frac{0}{1} + \frac{0}{1}\right)^{1/2}}{0.0667 \quad (59 / 100\ cm2)}$$

MDA = 69 dpm/100 cm²

METER 2220 w/44-9 SERIAL #: 50067

TS: 1 TB: 1 RB: 44 cpm EFF: 0.238 PROBE SIZE: 15 cm²

$$MDA = \frac{2.71/1 + 3.29\left(\frac{44}{1} + \frac{44}{1}\right)^{1/2}}{0.238 \quad (15 / 100\ cm2)}$$

Removable Only

MDA = 940 dpm/100 cm²

METER _____ SERIAL #: _____

TS: _____ TB: _____ RB: _____ EFF: _____ PROBE SIZE: _____

$$MDA = \frac{2.71 + 3.29(\_\_\_ + \_\_\_)^{1/2}}{(\quad / 100\ cm2)}$$

MDA = _____

Technician: D. L. Vann Date: 12/7/94

Reviewed by: [signature] Date: 12/7/94

By:	Date:	Project:	2278-300
Chkd:	Date:	Page #:	

Bausch & Lomb Release Survey Data

Survey Unit: **R&D Area**

Activity (dpm/100cm^2)

Location Number	Removable α			Removable β–γ		
	Activity	Uncertainty *	MDA	Activity	Uncertainty *	MDA
1	69	16	69	940	64	940
2	69	16	69	940	64	940
3	69	16	69	940	64	940
4	69	16	69	940	64	940
5	69	16	69	940	64	940
6	69	16	69	940	64	940
7	69	16	69	940	64	940
8	69	16	69	940	64	940
9	69	16	69	940	64	940
10	69	16	69	940	64	940
11	69	16	69	940	64	940
12	69	16	69	940	64	940
13	69	16	69	940	64	940
14	69	16	69	940	64	940
15	69	16	69	940	64	940
16	69	16	69	940	64	940
17	69	16	69	940	64	940
18	69	16	69	940	64	940
19	69	16	69	940	64	940
20	69	16	69	940	64	940
21	69	16	69	940	64	940
22	69	16	69	940	64	940
23	69	16	69	940	64	940
24	69	16	69	940	64	940
25	69	16	69	940	64	940
26	69	16	69	940	64	940
27	69	16	69	940	64	940
28	69	16	69	940	64	940
29	69	16	69	940	64	940
30	69	16	69	940	64	940

* Uncertainties represent the 95% Confidence level, based on counting statistics.
When survey data indicated less than MDA, the MDA value was used in the calculation.

By:	Date:	Project:	2278-300
Chkd:	Date:	Page #:	

Bausch & Lomb Release Survey Data

Survey Unit: **R&D Area**

Activity (dpm/100cm^2)

Location Number	Direct α			Direct β–γ		
	Activity	Uncertainty *	MDA	Activity	Uncertainty *	MDA
1	69	16	69	1360	79	1360
2	69	16	69	2800	109	1360
3	69	16	69	1360	79	1360
4	69	16	69	1360	79	1360
5	69	16	69	1360	79	1360
6	69	16	69	1360	79	1360
7	69	16	69	1360	79	1360
8	69	16	69	1360	79	1360
9	69	16	69	1360	79	1360
10	69	16	69	1360	79	1360
11	69	16	69	1360	79	1360
12	69	16	69	1360	79	1360
13	69	16	69	1360	79	1360
14	69	16	69	1360	79	1360
15	69	16	69	1360	79	1360
16	69	16	69	1360	79	1360
17	69	16	69	1360	79	1360
18	69	16	69	1360	79	1360
19	69	16	69	2240	98	1360
20	69	16	69	1360	79	1360
21	69	16	69	1360	79	1360
22	69	16	69	1360	79	1360
23	69	16	69	3360	118	1360
24	69	16	69	1360	79	1360
25	69	16	69	1360	79	1360
26	69	16	69	1360	79	1360
27	69	16	69	1360	79	1360
28	69	16	69	1360	79	1360
29	69	16	69	1360	79	1360
30	69	16	69	1360	79	1360

* Uncertainties represent the 95% Confidence level, based on counting statistics.
When survey data indicated less than MDA, the MDA value was used in the calculation.

NINETY-FIVE PERCENT CONFIDENCE CALCULATION SHEET

Survey Unit Bausch & Lomb R&D Area Date 12-7-94

Meter Ludlum 2220 Serial # 50067

Probe AC-3 Serial # 712582

MDA 69 dpm/100cm² Survey Type Removable

Guideline Value 200 (dpm/100cm²)

Average Measurement Level

$$x_{ave} = \frac{1}{n_s} \sum_{i=1}^{n_s} x_i$$

where:

x_{ave}	=	calculated mean for a survey unit,
n_s	=	number of measurements within a survey unit,
x_i	=	systematic and random measurements at point (i)

Σx_i 2070 n_s 30 x_{ave} = 69

Standard Deviation

$$S_x = \sqrt{\frac{\sum_{i=1}^{n_s} (x_{ave} - x_i)^2}{n_s - 1}}$$

where:

S_x	=	standard deviation
n_s	=	number of measurements within a survey unit
x_i	=	systematic and random measurements at point (i)
x_{ave}	=	calculated mean for a survey unit

x_{ave} = 69 n_s = 30

$\Sigma (x_{ave} - x_i)^2$ = 0 s_x = 0

$$\mu_\alpha = x_{ave} + t_{1-\alpha,df} \frac{s_x}{\sqrt{n_s}},$$

where:

μ_α	=	value compared guideline value to determine 95% Confidence Level
x_{ave}	=	calculated mean for a survey unit,
$t_{1-\alpha,df}$	=	95% confidence level for n-1 degrees of freedom (from NUREG/CR-5849, Table B-1, "Factors for Comparison of Survey Data")
s_x	=	standard deviation of measurements in a survey unit, and
n_s	=	number of measurements within a survey unit used to determine x_{ave} and s_x.

x_{ave} = 69

$t_{1-\alpha,df}$ = 1.699

s_x = 0

n_s = 30

μ_α = 69

NOTE: When determining x_{ave}, only minimum detectable activity (MDA) values were available for some measurements locations; the MDA values were therefore used as actual activity levels for the purpose of performing this calculation.

The site specific guideline values for this project are 5000 dpm/100 cm² fixed plus removable and 1000 dpm/100 cm² removable for beta-gamma emitting nuclides, and 1000 dpm/100 cm² fixed plus removable and 200 for alpha emitting nuclides. If μ_α is less than the specific guideline value, the data for this survey unit satisfies the guideline at the 95% confidence level. If μ_α is greater than the specific guideline value, further remediation of the survey unit is necessary.

Individual Completing Form: D. L. Vann Date: 12-7-94

Reviewed By: R Kyle Date: 1/10/95

NINETY-FIVE PERCENT CONFIDENCE CALCULATION SHEET

Survey Unit Bausch & Lomb R&D Area Date 12-7-94

Meter Ludlum 2220 Serial # 50067

Probe AC-3 Serial # 712582

MDA 69 dpm/100cm² Survey Type Direct α

Guideline Value 1000 (dpm/100cm²)

Average Measurement Level

$$x_{ave} = \frac{1}{n_s} \sum_{i=1}^{n_s} x_i$$

where:

x_{ave}	=	calculated mean for a survey unit,
n_s	=	number of measurements within a survey unit,
x_i	=	systematic and random measurements at point (i)

Σx_i 2070 n_s 30 x_{ave} = 69

Standard Deviation

$$S_x = \sqrt{\frac{\sum_{i=1}^{n_s} (x_{ave} - x_i)^2}{n_s - 1}}$$

where:

S_x	=	standard deviation
n_s	=	number of measurements within a survey unit
x_i	=	systematic and random measurements at point (i)
x_{ave}	=	calculated mean for a survey unit

x_{ave} = 69 n_s = 30

$\Sigma (x_{ave} - x_i)^2$ = 0 S_x = 0

$$\mu_\alpha = x_{ave} + t_{1-\alpha,df} \frac{s_x}{\sqrt{n_s}},$$

where:

μ_α	=	value compared guideline value to determine 95% Confidence Level
x_{ave}	=	calculated mean for a survey unit,
$t_{1-\alpha,df}$	=	95% confidence level for n-1 degrees of freedom (from NUREG/CR-5849, Table B-1, "Factors for Comparison of Survey Data")
s_x	=	standard deviation of measurements in a survey unit, and
n_s	=	number of measurements within a survey unit used to determine x_{ave} and s_x.

x_{ave} = 69

$t_{1-\alpha,df}$ = 1.699

s_x = 0

n_s = 30

μ_α = 69

NOTE: When determining x_{ave}, only minimum detectable activity (MDA) values were available for some measurements locations; the MDA values were therefore used as actual activity levels for the purpose of performing this calculation.

The site specific guideline values for this project are 5000 dpm/100 cm^2 fixed plus removable and 1000 dpm/100 cm^2 removable for beta-gamma emitting nuclides, and 1000 dpm/100 cm^2 fixed plus removable and 200 for alpha emitting nuclides. If μ_α is less than the specific guideline value, the data for this survey unit satisfies the guideline at the 95% confidence level. If μ_α is greater than the specific guideline value, further remediation of the survey unit is necessary.

Individual Completing Form: O. L. Vann Date: 12-7-94

Reviewed By: R Wyatt Date: 1/10/95

NINETY-FIVE PERCENT CONFIDENCE CALCULATION SHEET

Survey Unit Bausch + Lomb R+D Area Date 12-7-94

Meter Ludlum 2220 Serial # 50061

Probe 44-9 Serial # PR066761

MDA 940 dpm/100cm^2 Survey Type Removable B-γ

Guideline Value 1006 (dpm/100cm^2)

Average Measurement Level

$$x_{ave} = \frac{1}{n_s} \sum_{i=1}^{n_s} x_i$$

where:

x_{ave}	=	calculated mean for a survey unit,
n_s	=	number of measurements within a survey unit,
x_i	=	systematic and random measurements at point (i)

Σx_i 28,200 n_s 30 x_{ave} = 940

Standard Deviation

$$S_x = \sqrt{\frac{\sum_{i=1}^{n_s} (x_{ave} - x_i)^2}{n_s - 1}}$$

where:

S_x	=	standard deviation
n_s	=	number of measurements within a survey unit
x_i	=	systematic and random measurements at point (i)
x_{ave}	=	calculated mean for a survey unit

x_{ave} = 940 n_s = 30

$\Sigma (x_{ave} - x_i)^2$ = 0 s_x = 0

$$\mu_\alpha = x_{ave} + t_{1-\alpha,df} \frac{s_x}{\sqrt{n_s}},$$

where:

μ_α	=	value compared guideline value to determine 95% Confidence Level
x_{ave}	=	calculated mean for a survey unit,
$t_{1-\alpha,df}$	=	95% confidence level for n-1 degrees of freedom (from NUREG/CR-5849, Table B-1, "Factors for Comparison of Survey Data")
s_x	=	standard deviation of measurements in a survey unit, and
n_s	=	number of measurements within a survey unit used to determine x_{ave} and s_x.

x_{ave} = 940

$t_{1-\alpha,df}$ = 1.699

s_x = 0

n_s = 30

μ_α = 940

NOTE: When determining x_{ave}, only minimum detectable activity (MDA) values were available for some measurements locations; the MDA values were therefore used as actual activity levels for the purpose of performing this calculation.

The site specific guideline values for this project are 5000 dpm/100 cm² fixed plus removable and 1000 dpm/100 cm² removable for beta-gamma emitting nuclides, and 1000 dpm/100 cm² fixed plus removable and 200 for alpha emitting nuclides. If μ_α is less than the specific guideline value, the data for this survey unit satisfies the guideline at the 95% confidence level. If μ_α is greater than the specific guideline value, further remediation of the survey unit is necessary.

Individual Completing Form: D. L. Vann Date: 12-7-94

Reviewed By: R. Kryla Date: 1/10/95

NINETY-FIVE PERCENT CONFIDENCE CALCULATION SHEET

Survey Unit Bausch & Lomb R&D Area Date 12-7-94

Meter Ludlum 2220 Serial # 52836

Probe 44-9 Serial # PRO 68918

MDA 1360 dpm/100cm² Survey Type Direct B-γ

Guideline Value 5000 (dpm/100cm²)

Average Measurement Level

$$x_{ave} = \frac{1}{n_s} \sum_{i=1}^{n_s} x_i$$

where:

x_{ave}	=	calculated mean for a survey unit,
n_s	=	number of measurements within a survey unit,
x_i	=	systematic and random measurements at point (i)

Σx_i 45,120 n_s 30 x_{ave} = 1504

Standard Deviation

$$S_x = \sqrt{\frac{\sum_{i=1}^{n_s} (x_{ave} - x_i)^2}{n_s - 1}}$$

where:

S_x	=	standard deviation
n_s	=	number of measurements within a survey unit
x_i	=	systematic and random measurements at point (i)
x_{ave}	=	calculated mean for a survey unit

x_{ave} = 1504 n_s = 30

$\Sigma (x_{ave} - x_i)^2$ = 6,225,920 S_x = 463.3

$$\mu_\alpha = x_{ave} + t_{1-\alpha,df} \frac{s_x}{\sqrt{n_s}},$$

where:

μ_α	=	value compared guideline value to determine 95% Confidence Level
x_{ave}	=	calculated mean for a survey unit,
$t_{1-\alpha,df}$	=	95% confidence level for n-1 degrees of freedom (from NUREG/CR-5849, Table B-1, "Factors for Comparison of Survey Data")
s_x	=	standard deviation of measurements in a survey unit, and
n_s	=	number of measurements within a survey unit used to determine x_{ave} and s_x.

x_{ave} = 1504

$t_{1-\alpha,df}$ = 1.699

s_x = 463.3

n_s = 30

μ_α = 1647.7

NOTE: When determining x_{ave}, only minimum detectable activity (MDA) values were available for some measurements locations; the MDA values were therefore used as actual activity levels for the purpose of performing this calculation.

The site specific guideline values for this project are 5000 dpm/100 cm² fixed plus removable and 1000 dpm/100 cm² removable for beta-gamma emitting nuclides, and 1000 dpm/100 cm² fixed plus removable and 200 for alpha emitting nuclides. If μ_α is less than the specific guideline value, the data for this survey unit satisfies the guideline at the 95% confidence level. If μ_α is greater than the specific guideline value, further remediation of the survey unit is necessary.

Individual Completing Form: D. L. Vonn Date: 12-7-94

Reviewed By: R. Kyle Date: 1/10/95

NINETY-FIVE PERCENT CONFIDENCE CALCULATION SHEET

Survey Unit Bansch & Lomb R & D Area Date 12-7-94

Meter Bicron MicroRem Serial # BZ18L

Probe NA Serial # NA

MDA NA Survey Type Exposure

Guideline Value* 10 mRem/hr ~~(dpm/100cm²)~~ BLG 1-13-95

*INCLUDES BLGD

Average Measurement Level

$$x_{ave} = \frac{1}{n_s} \sum_{i=1}^{n_s} x_i$$

where:

x_{ave}	=	calculated mean for a survey unit,
n_s	=	number of measurements within a survey unit,
x_i	=	systematic and random measurements at point (i)

Σx_i 143 n_s 30 x_{ave} = 4.8

Standard Deviation

$$S_x = \sqrt{\frac{\sum_{i=1}^{n_s} (x_{ave} - x_i)^2}{n_s - 1}}$$

where:

S_x	=	standard deviation
n_s	=	number of measurements within a survey unit
x_i	=	systematic and random measurements at point (i)
x_{ave}	=	calculated mean for a survey unit

x_{ave} = 4.8 n_s = 30

$\Sigma (x_{ave} - x_i)^2$ = 5.4 s_x = 0.4

$$\mu_\alpha = x_{ave} + t_{1-\alpha,df} \frac{s_x}{\sqrt{n_s}},$$

where:

μ_α	=	value compared guideline value to determine 95% Confidence Level
x_{ave}	=	calculated mean for a survey unit,
$t_{1-\alpha,df}$	=	95% confidence level for n-1 degrees of freedom (from NUREG/CR-5849, Table B-1, "Factors for Comparison of Survey Data")
s_x	=	standard deviation of measurements in a survey unit, and
n_s	=	number of measurements within a survey unit used to determine x_{ave} and s_x.

x_{ave} = 4.8

$t_{1-\alpha,df}$ = 1.699

s_x = 0.4

n_s = 30

μ_α = 4.9

NOTE: When determining x_{ave}, only minimum detectable activity (MDA) values were available for some measurements locations; the MDA values were therefore used as actual activity levels for the purpose of performing this calculation.

The site specific guideline values for this project are 5000 dpm/100 cm² fixed plus removable and 1000 dpm/100 cm² removable for beta-gamma emitting nuclides, and 1000 dpm/100 cm² fixed plus removable and 200 for alpha emitting nuclides. If μ_α is less than the specific guideline value, the data for this survey unit satisfies the guideline at the 95% confidence level. If μ_α is greater than the specific guideline value, further remediation of the survey unit is necessary.

Individual Completing Form: D. L. Vann Date: 12-7-94

Reviewed By: R. Knight Date: 1/10/95

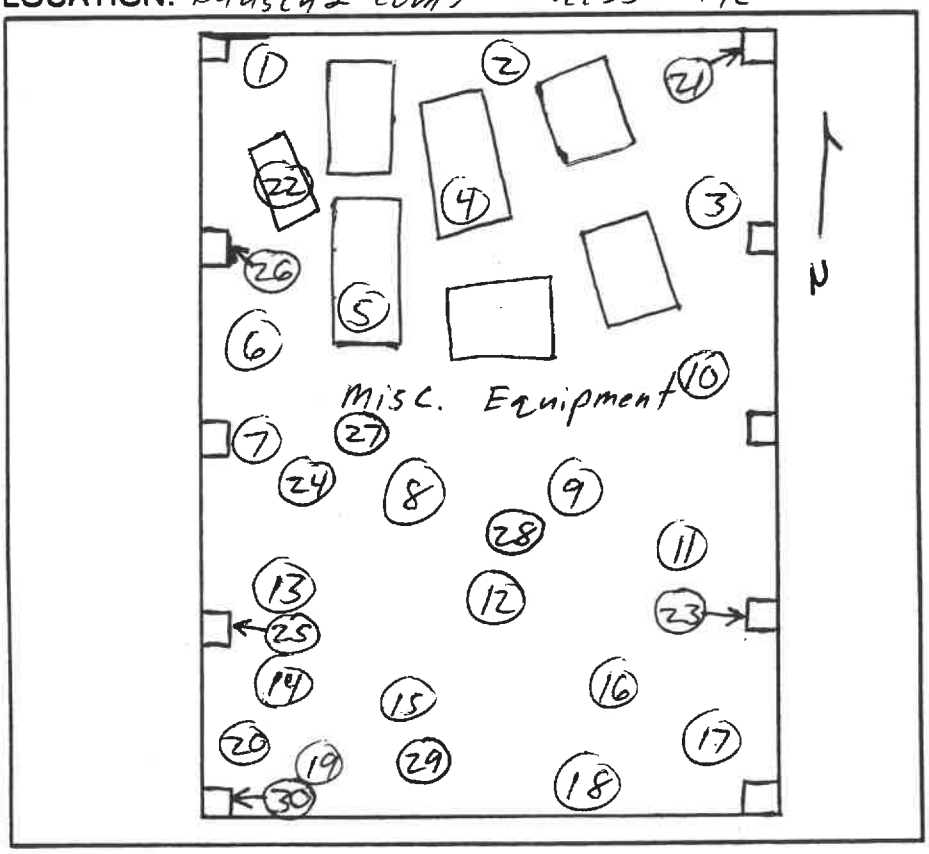
SURVEYOR D.L. Vann for Kevin Graczyk DATE 12-7-94

REVIEWER B Dulo TIME 1610

SURVEY METERS

MODEL Ludlum 2220	MODEL Ludlum 2220	MODEL Bicron
SERIAL # 52836	SERIAL # 50067	SERIAL # B218L
CAL DUE 10/17/94	CAL DUE 10/17/95	CAL DUE 10/14/95
EFFICIENCY 0.239	EFFICIENCY 0.0667	EFFICIENCY NA
TYPE 44-9	TYPE Ac-3	TYPE Micro Rem
BKG 98 cpm	BKG 0 cpm	BKG 5 mRem/hr
MDA 1360 dpm/100cm²	MDA 69 dpm/100cm²	MDA NA

LOCATION: Bausch & Lomb Process Line



SMEAR #	dpm/100 cm² βγ	dpm/100 cm² α
See	Attached	
	N	
	A	

NOTE: Smear results in dpm/100 cm² unless otherwise noted. (1) denotes smear location. An * followed by a number in dpm (i.e., * 100 dpm) denotes direct probe readings in dpm/100 cm². # denotes dose rates in mR/hr.

PURPOSE: Unaffected Area Release Survey

AVERAGE CONTAMINATION SURVEY RESULTS

DATE: 12/7/94 LOCATION: Bausch & Lomb Process Line

INSTRUMENT: Ludlum 2220 S# 50067 (MODEL / NUMBER) PROBE: AC-3 (MODEL) EFF: 0.0667

GRID NUMBER	dpm/100cm2	GRID NUMBER	dpm/100cm2
1	< 69	20	< 69
2	< 69	21	< 69
3	< 69	22	< 69
4	< 69	23	< 69
5	< 69	24	< 69
6	< 69	25	< 69
7	< 69	26	< 69
8	< 69	27	< 69
9	< 69	28	< 69
10	< 69	29	< 69
11	< 69	30	< 69
12	< 69		
13	< 69		
14	< 69		
15	< 69	N	
16	< 69	A	
17	< 69		
18	< 69		
19	< 69		

Average Background counts per minute 0

MDA (dpm/100cm 2) 69

*BASED ON AVERAGE OF 5 DIRECT MEASUREMENTS
(INITIAL DIRECT MEASUREMENT WAS GREATER THAN 60% OF GUIDELINE VALUE)

$$\frac{\text{dpm}}{100\text{cm}^2} = \frac{(\text{gross count rate}) - (\text{background count rate})}{(\text{efficiency})\ \frac{(\text{probe area})}{100\text{cm}^2}}$$

SURVEYOR D. L. Vann for Kevin Graczyk

SUPERVISOR B Drake

AVERAGE CONTAMINATION SURVEY RESULTS

DATE: 12/7/94 LOCATION: Bausch&Lomb Process Line

INSTRUMENT: Ludlum 2220 S# 52836 (MODEL / NUMBER) PROBE: 44-9 (MODEL) EFF: 0.239

GRID NUMBER	dpm/100cm2	GRID NUMBER	dpm/100cm2
1	< 1360	20	< 1360
2	< 1360	21	< 1360
3	< 1360	22	< 1360
4	< 1360	23	< 1360
5	< 1360	24	< 1360
6	< 1360	25	< 1360
7	< 1360	26	< 1360
8	< 1360	27	< 1360
9	< 1360	28	< 1360
10	< 1360	29	< 1360
11	< 1360	30	< 1360
12	< 1360		
13	< 1360		
14	< 1360		
15	< 1360	N	
16	< 1360	A	
17	< 1360		
18	< 1360		
19	< 1360		

Average Background counts per minute 98

MDA (dpm/100cm 2) 1360

*BASED ON AVERAGE OF 5 DIRECT MEASUREMENTS
(INITIAL DIRECT MEASUREMENT WAS GREATER THAN 60% OF GUIDELINE VALUE)

$$\frac{\text{dpm}}{100\text{cm}^2} = \frac{(\text{gross count rate}) - (\text{background count rate})}{(\text{efficiency})\ \frac{(\text{probe area})}{100\text{cm}^2}}$$

SURVEYOR D. L. Yunn for Kevin Graczyk

SUPERVISOR [signature]

REMOVABLE CONTAMINATION

DATE: 12/7/94 LOCATION: Bausch Lomb Process Line

COUNTER: Ludlum 2220 S# 50067 (Model / Number) EFFICIENCY: 0.0667 (Alpha) NA (Beta/Gamma)

LOCATION	DPM/100cm² βγ	DPM/100cm² α	LOCATION	DPM/100cm² βγ	DPM/100cm² α	LOCATION	DPM/100cm² βγ	DPM/100cm² α
1		< 69	21		< 69			
2		< 69	22		< 69			
3		< 69	23		< 69			
4		< 69	24		< 69			
5		< 69	25		< 69			
6		< 69	26	NA	< 69			
7		< 69	27		< 69			
8		< 69	28		< 69			
9		< 69	29		< 69			
10		< 69	30		< 69			
11	NA	< 69					NA	
12		< 69						
13		< 69						
14		< 69						
15		< 69		N				
16		< 69		A				
17		< 69						
18		< 69						
19		< 69						
20		< 69						

ALPHA BKG COUNT RATE: 0 cpm

BETA/GAMMA BKG COUNT RATE: NA

α MDA (dpm/100cm²) 69

βγ MDA (dpm/100cm²) NA

SURVEYOR D.L. Vann for Kevin Groczyk

SUPERVISOR [signature]

REMOVABLE CONTAMINATION

DATE: 12/7/94 LOCATION: Bausch & Lomb Process Line

COUNTER: Ludlum 2220 S# 50061 EFFICIENCY: NA 0.238

Model Number Alpha Beta/Gamma

LOCATION	DPM/100cm² βγ	α	LOCATION	DPM/100cm² βγ	α	LOCATION	DPM/100cm² βγ	α
1	< 940		21	< 940				
2	< 940		22	< 940				
3	< 940		23	< 940				
4	< 940		24	< 940				
5	< 940		25	< 940	N			
6	< 940		26	< 940	A			
7	< 940		27	< 940				
8	< 940		28	< 940				
9	< 940		29	< 940				
10	< 940	N	30	< 940				N
11	< 940	A						A
12	< 940							
13	< 940							
14	< 940							
15	< 940				N			
16	< 940				A			
17	< 940							
18	< 940							
19	< 940							
20	< 940							

ALPHA BKG COUNT RATE: NA

BETA/GAMMA BKG COUNT RATE: 44 cpm

α MDA (dpm/100cm²) NA

βγ MDA (dpm/100cm²) 940

SURVEYOR B Dale

SUPERVISOR D. L. Vann

EXPOSURE RATE SURVEY RESULTS

DATE: 12-7-94 LOCATION: Bausch and Lomb Process Line

INSTRUMENT: Bicron B 218L CAL DUE: 10-14-95

GRID NUMBER	EXPOSURE RATE µR/h		GRID NUMBER	EXPOSURE RATE µR/h	
X RED	1cm	1m		1cm	1m
1		5 uR/hr	18		6 uR/hr
2		5 uR/hr	19		6 uR/hr
3		5 uR/hr	20		6 uR/hr
4		5 uR/hr	21		5 uR/hr
5		5 uR/hr	22		5 uR/hr
6		5 uR/hr	23		5 uR/hr
7		5 uR/hr	24	N/A	5 uR/hr
8		5 uR/hr	25		5 uR/hr
9	N/A	5 uR/hr	26		5 uR/hr
10		5 uR/hr	27		5 uR/hr
11		5 uR/hr	28		5 uR/hr
12		5 uR/hr	29		6 uR/hr
13		5 uR/hr	30	N/A	6 uR/hr
14		5 uR/hr			
15		5 uR/hr	N		
16		5 uR/hr		A	
17	6 uR/hr	5 uR/hr			

MEASUREMENTS TAKEN AT 1cm AND/OR 1m ABOVE THE FLOOR.

BKG: 5 uR/hr

SURVEYOR Kevin R. Daniel

SUPERVISOR Brenda Lake

MDA CALCULATION SHEET

METER 2220 w/449 SERIAL #: 52836

TS: 1 TB: 1 RB: 98 cpm EFF: 0.239 PROBE SIZE: 15 cm²

$$MDA = \frac{\frac{2.71}{1} + 3.29\left(\frac{98}{1} + \frac{98}{1}\right)^{1/2}}{0.239 \left(\frac{15}{100\ cm^2}\right)}$$

MDA = 1360 dpm/100 cm²

METER 2220 w/Ac-3 SERIAL #: 50067

TS: 1 TB: 1 RB: 0 cpm EFF: 0.0667 PROBE SIZE: 59 cm²

$$MDA = \frac{\frac{2.71}{1} + 3.29\left(\frac{0}{1} + \frac{0}{1}\right)^{1/2}}{0.0667 \left(\frac{59}{100\ cm^2}\right)}$$

MDA = 69 dpm/100 cm²

METER 2220 w/449 SERIAL #: 50061

TS: 1 TB: 1 RB: 44 EFF: 0.238 PROBE SIZE: 15 cm²

$$MDA = \frac{\frac{2.71}{1} + 3.29\left(\frac{44}{1} + \frac{44}{1}\right)^{1/2}}{0.238 \left(\frac{15}{100\ cm^2}\right)}$$

Removable only

MDA = 940 dpm/100 cm²

METER _____ SERIAL #: _____

TS: _____ TB: _____ RB: _____ EFF: _____ PROBE SIZE: _____

$$MDA = \frac{\frac{2.71}{\ } + 3.29\left(\frac{\ }{\ } + \frac{\ }{\ }\right)^{1/2}}{\left(\frac{\ }{100\ cm^2}\right)}$$

MDA = _____

Technician: D. L. Vann Date: 12/7/94

Reviewed by: B Date: 12/7/94

By:	Date:	Project:	2278-300
Chkd:	Date:	Page #:	

Bausch & Lomb Release Survey Data

Survey Unit: **Process Line**

Activity (dpm/100cm^2)

Location Number	Removable α			Removable β–γ		
	Activity	Uncertainty *	MDA	Activity	Uncertainty *	MDA
1	69	16	69	940	64	940
2	69	16	69	940	64	940
3	69	16	69	940	64	940
4	69	16	69	940	64	940
5	69	16	69	940	64	940
6	69	16	69	940	64	940
7	69	16	69	940	64	940
8	69	16	69	940	64	940
9	69	16	69	940	64	940
10	69	16	69	940	64	940
11	69	16	69	940	64	940
12	69	16	69	940	64	940
13	69	16	69	940	64	940
14	69	16	69	940	64	940
15	69	16	69	940	64	940
16	69	16	69	940	64	940
17	69	16	69	940	64	940
18	69	16	69	940	64	940
19	69	16	69	940	64	940
20	69	16	69	940	64	940
21	69	16	69	940	64	940
22	69	16	69	940	64	940
23	69	16	69	940	64	940
24	69	16	69	940	64	940
25	69	16	69	940	64	940
26	69	16	69	940	64	940
27	69	16	69	940	64	940
28	69	16	69	940	64	940
29	69	16	69	940	64	940
30	69	16	69	940	64	940

* Uncertainties represent the 95% Confidence level, based on counting statistics.
When survey data indicated less than MDA, the MDA value was used in the calculation.

By:	Date:	Project:	2278-300
Chkd:	Date:	Page #:	

Bausch & Lomb Release Survey Data

Survey Unit: **Process Line**

Activity (dpm/100cm^2)

Location Number	Direct α			Direct β–γ		
	Activity	Uncertainty *	MDA	Activity	Uncertainty *	MDA
1	69	16	69	1360	79	1360
2	69	16	69	1360	79	1360
3	69	16	69	1360	79	1360
4	69	16	69	1360	79	1360
5	69	16	69	1360	79	1360
6	69	16	69	1360	79	1360
7	69	16	69	1360	79	1360
8	69	16	69	1360	79	1360
9	69	16	69	1360	79	1360
10	69	16	69	1360	79	1360
11	69	16	69	1360	79	1360
12	69	16	69	1360	79	1360
13	69	16	69	1360	79	1360
14	69	16	69	1360	79	1360
15	69	16	69	1360	79	1360
16	69	16	69	1360	79	1360
17	69	16	69	1360	79	1360
18	69	16	69	1360	79	1360
19	69	16	69	1360	79	1360
20	69	16	69	1360	79	1360
21	69	16	69	1360	79	1360
22	69	16	69	1360	79	1360
23	69	16	69	1360	79	1360
24	69	16	69	1360	79	1360
25	69	16	69	1360	79	1360
26	69	16	69	1360	79	1360
27	69	16	69	1360	79	1360
28	69	16	69	1360	79	1360
29	69	16	69	1360	79	1360
30	69	16	69	1360	79	1360

* Uncertainties represent the 95% Confidence level, based on counting statistics.
When survey data indicated less than MDA, the MDA value was used in the calculation.

NINETY-FIVE PERCENT CONFIDENCE CALCULATION SHEET

Survey Unit Process Line Date 12-7-94

Meter Ludlum 2220 Serial # 52836

Probe 44-9 Serial # PRO 68918

MDA 1360 Survey Type Direct B-S

Guideline Value 5000 (dpm/100cm²)

Average Measurement Level

$$x_{ave} = \frac{1}{n_s} \sum_{i=1}^{n_s} x_i$$

where:

x_{ave}	=	calculated mean for a survey unit,
n_s	=	number of measurements within a survey unit,
x_i	=	systematic and random measurements at point (i)

Σx_i 40,800 n_s 30 x_{ave} = 1360

Standard Deviation

$$S_x = \sqrt{\frac{\sum_{i=1}^{n_s} (x_{ave} - x_i)^2}{n_s - 1}}$$

where:

S_x	=	standard deviation
n_s	=	number of measurements within a survey unit
x_i	=	systematic and random measurements at point (i)
x_{ave}	=	calculated mean for a survey unit

x_{ave} = 1360 n_s = 30

$\Sigma (x_{ave} - x_i)^2$ = 0 S_x = 0

$$\mu_\alpha = x_{ave} + t_{1-\alpha,df} \frac{s_x}{\sqrt{n_s}},$$

where:

μ_α	=	value compared guideline value to determine 95% Confidence Level
x_{ave}	=	calculated mean for a survey unit,
$t_{1-\alpha,df}$	=	95% confidence level for n-1 degrees of freedom (from NUREG/CR-5849, Table B-1, "Factors for Comparison of Survey Data")
s_x	=	standard deviation of measurements in a survey unit, and
n_s	=	number of measurements within a survey unit used to determine x_{ave} and s_x.

x_{ave} = 1360

$t_{1-\alpha,df}$ = 1,699

s_x = 0

n_s = 30

μ_α = 1360

NOTE: When determining x_{ave}, only minimum detectable activity (MDA) values were available for some measurements locations; the MDA values were therefore used as actual activity levels for the purpose of performing this calculation.

The site specific guideline values for this project are 5000 dpm/100 cm² fixed plus removable and 1000 dpm/100 cm² removable for beta-gamma emitting nuclides, and 1000 dpm/100 cm² fixed plus removable and 200 for alpha emitting nuclides. If μ_α is less than the specific guideline value, the data for this survey unit satisfies the guideline at the 95% confidence level. If μ_α is greater than the specific guideline value, further remediation of the survey unit is necessary.

Individual Completing Form: D. L. Vann Date: 12-7-94

Reviewed By: R Kyfft Date: 1/10/95

NINETY-FIVE PERCENT CONFIDENCE CALCULATION SHEET

Survey Unit Process Line Date 12-7-94

Meter Ludlum 2220 Serial # 50067

Probe AC-3 Serial # 712582

MDA 69 dpm/100cm² Survey Type Direct α

Guideline Value 1000 (dpm/100cm²)

Average Measurement Level

$$x_{ave} = \frac{1}{n_s} \sum_{i=1}^{n_s} x_i$$

where:

x_{ave}	=	calculated mean for a survey unit,
n_s	=	number of measurements within a survey unit,
x_i	=	systematic and random measurements at point (i)

Σx_i 2070 n_s 30 x_{ave} = 69

Standard Deviation

$$S_x = \sqrt{\frac{\sum_{i=1}^{n_s} (x_{ave} - x_i)^2}{n_s - 1}}$$

where:

S_x	=	standard deviation
n_s	=	number of measurements within a survey unit
x_i	=	systematic and random measurements at point (i)
x_{ave}	=	calculated mean for a survey unit

x_{ave} = 69 n_s = 30

$\Sigma (x_{ave} - x_i)^2$ = 0 S_x = 0

$$\mu_\alpha = x_{ave} + t_{1-\alpha,df} \frac{s_x}{\sqrt{n_s}},$$

where:

μ_α	=	value compared guideline value to determine 95% Confidence Level
x_{ave}	=	calculated mean for a survey unit,
$t_{1-\alpha,df}$	=	95% confidence level for n-1 degrees of freedom (from NUREG/CR-5849, Table B-1, "Factors for Comparison of Survey Data")
s_x	=	standard deviation of measurements in a survey unit, and
n_s	=	number of measurements within a survey unit used to determine x_{ave} and s_x.

x_{ave} = 69

$t_{1-\alpha,df}$ = 1.699

s_x = 0

n_s = 30

μ_α = 69

NOTE: When determining x_{ave}, only minimum detectable activity (MDA) values were available for some measurements locations; the MDA values were therefore used as actual activity levels for the purpose of performing this calculation.

The site specific guideline values for this project are 5000 dpm/100 cm² fixed plus removable and 1000 dpm/100 cm² removable for beta-gamma emitting nuclides, and 1000 dpm/100 cm² fixed plus removable and 200 for alpha emitting nuclides. If μ_α is less than the specific guideline value, the data for this survey unit satisfies the guideline at the 95% confidence level. If μ_α is greater than the specific guideline value, further remediation of the survey unit is necessary.

Individual Completing Form: D. L. Vann Date: 12-7-94

Reviewed By: F Knight Date: 1/10/95

NINETY-FIVE PERCENT CONFIDENCE CALCULATION SHEET

Survey Unit Process Line Date 12-7-94

Meter Ludlum 2220 Serial # 50061

Probe 44-9 Serial # PRO 66761

MDA 940 dpm/100cm² Survey Type Removable B-Y

Guideline Value 1000 (dpm/100cm²)

Average Measurement Level

$$x_{ave} = \frac{1}{n_s} \sum_{i=1}^{n_s} x_i$$

where:

x_{ave}	=	calculated mean for a survey unit,
n_s	=	number of measurements within a survey unit,
x_i	=	systematic and random measurements at point (i)

Σx_i 28,200 n_s 30 x_{ave} = 940

Standard Deviation

$$S_x = \sqrt{\frac{\sum_{i=1}^{n_s} (x_{ave} - x_i)^2}{n_s - 1}}$$

where:

S_x	=	standard deviation
n_s	=	number of measurements within a survey unit
x_i	=	systematic and random measurements at point (i)
x_{ave}	=	calculated mean for a survey unit

x_{ave} = 940 n_s = 30

$\Sigma (x_{ave} - x_i)^2$ = 0 s_x = 0

$$\mu_\alpha = x_{ave} + t_{1-\alpha,df} \frac{s_x}{\sqrt{n_s}},$$

where:

μ_α	=	value compared guideline value to determine 95% Confidence Level
x_{ave}	=	calculated mean for a survey unit,
$t_{1-\alpha,df}$	=	95% confidence level for n-1 degrees of freedom (from NUREG/CR-5849, Table B-1, "Factors for Comparison of Survey Data")
s_x	=	standard deviation of measurements in a survey unit, and
n_s	=	number of measurements within a survey unit used to determine x_{ave} and s_x.

x_{ave} = 940

$t_{1-\alpha,df}$ = 1.699

s_x = 0

n_s = 30

μ_α = 940

NOTE: When determining x_{ave}, only minimum detectable activity (MDA) values were available for some measurements locations; the MDA values were therefore used as actual activity levels for the purpose of performing this calculation.

The site specific guideline values for this project are 5000 dpm/100 cm² fixed plus removable and 1000 dpm/100 cm² removable for beta-gamma emitting nuclides, and 1000 dpm/100 cm² fixed plus removable and 200 for alpha emitting nuclides. If μ_α is less than the specific guideline value, the data for this survey unit satisfies the guideline at the 95% confidence level. If μ_α is greater than the specific guideline value, further remediation of the survey unit is necessary.

Individual Completing Form: D. L. Vann Date: 12-7-94

Reviewed By: R. Kyle Date: 1/10/95

NINETY-FIVE PERCENT CONFIDENCE CALCULATION SHEET

Survey Unit Bausch & Lomb process Line Date 12-7-94

Meter Ludlum 2220 Serial # 50067

Probe AC-3 Serial # 712582

MDA 69 dpm/100 cm² Survey Type Removable α

Guideline Value 200 (dpm/100cm²)

Average Measurement Level

$$x_{ave} = \frac{1}{n_s} \sum_{i=1}^{n_s} x_i$$

where:

x_{ave}	=	calculated mean for a survey unit,
n_s	=	number of measurements within a survey unit,
x_i	=	systematic and random measurements at point (i)

Σx_i 2070 n_s 30 x_{ave} = 69

Standard Deviation

$$S_x = \sqrt{\frac{\sum_{i=1}^{n_s} (x_{ave} - x_i)^2}{n_s - 1}}$$

where:

S_x	=	standard deviation
n_s	=	number of measurements within a survey unit
x_i	=	systematic and random measurements at point (i)
x_{ave}	=	calculated mean for a survey unit

x_{ave} = 69 n_s = 30

$\Sigma (x_{ave} - x_i)^2$ = 0 s_x = 0

$$\mu_\alpha = x_{ave} + t_{1-\alpha,df} \frac{s_x}{\sqrt{n_s}},$$

where:

μ_α	=	value compared guideline value to determine 95% Confidence Level
x_{ave}	=	calculated mean for a survey unit,
$t_{1-\alpha,df}$	=	95% confidence level for n-1 degrees of freedom (from NUREG/CR-5849, Table B-1, "Factors for Comparison of Survey Data")
s_x	=	standard deviation of measurements in a survey unit, and
n_s	=	number of measurements within a survey unit used to determine x_{ave} and s_x.

x_{ave} = 69

$t_{1-\alpha,df}$ = 1.699

s_x = 0

n_s = 30

μ_α = 69

NOTE: When determining x_{ave}, only minimum detectable activity (MDA) values were available for some measurements locations; the MDA values were therefore used as actual activity levels for the purpose of performing this calculation.

The site specific guideline values for this project are 5000 dpm/100 cm² fixed plus removable and 1000 dpm/100 cm² removable for beta-gamma emitting nuclides, and 1000 dpm/100 cm² fixed plus removable and 200 for alpha emitting nuclides. If μ_α is less than the specific guideline value, the data for this survey unit satisfies the guideline at the 95% confidence level. If μ_α is greater than the specific guideline value, further remediation of the survey unit is necessary.

Individual Completing Form: D. L. Vann Date: 12-7-94

Reviewed By: R. Kyle Date: 1/10/95

NINETY-FIVE PERCENT CONFIDENCE CALCULATION SHEET

Survey Unit Process Line Date 12-7-94

Meter Bicron MicroRem Serial # B 218 L

Probe NA Serial # NA

MDA NA Survey Type Exposure

Guideline Value 10 mRem/hr ~~(dpm/100cm²)~~

Average Measurement Level

$$x_{ave} = \frac{1}{n_s} \sum_{i=1}^{n_s} x_i$$

where:

x_{ave}	=	calculated mean for a survey unit,
n_s	=	number of measurements within a survey unit,
x_i	=	systematic and random measurements at point (i)

Σx_i 155 n_s 30 x_{ave} = 5,2

Standard Deviation

$$S_x = \sqrt{\frac{\sum_{i=1}^{n_s} (x_{ave} - x_i)^2}{n_s - 1}}$$

where:

S_x	=	standard deviation
n_s	=	number of measurements within a survey unit
x_i	=	systematic and random measurements at point (i).
x_{ave}	=	calculated mean for a survey unit

x_{ave} = 5,2 n_s = 30

$\Sigma (x_{ave} - x_i)^2$ = 4,2 s_x = 0,4

$$\mu_\alpha = x_{ave} + t_{1-\alpha,df} \frac{s_x}{\sqrt{n_s}},$$

where:

μ_α	=	value compared guideline value to determine 95% Confidence Level
x_{ave}	=	calculated mean for a survey unit,
$t_{1-\alpha,df}$	=	95% confidence level for n-1 degrees of freedom (from NUREG/CR-5849, Table B-1, "Factors for Comparison of Survey Data")
s_x	=	standard deviation of measurements in a survey unit, and
n_s	=	number of measurements within a survey unit used to determine x_{ave} and s_x.

x_{ave} = 5.2

$t_{1-\alpha,df}$ = 1.699

s_x = 0.4

n_s = 30

μ_α = 5.3

NOTE: When determining x_{ave}, only minimum detectable activity (MDA) values were available for some measurements locations; the MDA values were therefore used as actual activity levels for the purpose of performing this calculation.

The site specific guideline values for this project are 5000 dpm/100 cm^2 fixed plus removable and 1000 dpm/100 cm^2 removable for beta-gamma emitting nuclides, and 1000 dpm/100 cm^2 fixed plus removable and 200 for alpha emitting nuclides. If μ_α is less than the specific guideline value, the data for this survey unit satisfies the guideline at the 95% confidence level. If μ_α is greater than the specific guideline value, further remediation of the survey unit is necessary.

Individual Completing Form: D. L. Vann Date: 12-7-94

Reviewed By: [signature] Date: 1/10/95

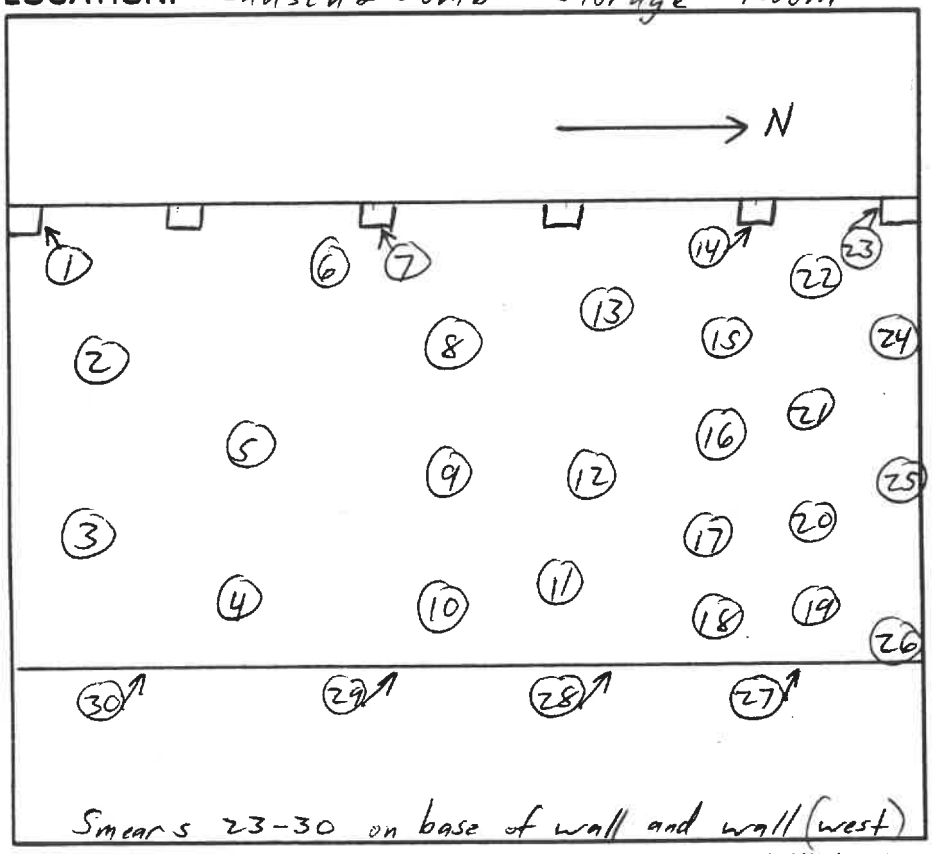
SURVEYOR D. L. Vann for Kevin Graczyk DATE 12-7-94

REVIEWER B Dale TIME 1000

SURVEY METERS

MODEL Ludlum 2220	MODEL Ludlum 2220	MODEL Bicron
SERIAL # 52836	SERIAL # 50067	SERIAL # B2/8L
CAL DUE 10-17-95	CAL DUE 10-17-95	CAL DUE 10-14-95
EFFICIENCY 0.239	EFFICIENCY 0.0667	EFFICIENCY NA
TYPE 44-9	TYPE AC-3	TYPE Micro Rem
BKG 98 cpm	BKG 0 cpm	BKG 5 mRem/hr
MDA 1360 dpm/100cm²	MDA 69 dpm/100cm²	MDA NA

LOCATION: Bausch & Lomb Storage Room



SMEAR #	dpm/100 cm² βγ	dpm/100 cm² α
See	attached	
	N	
	A	

NOTE: Smear results in dpm/100 cm² unless otherwise noted. (1) denotes smear location. An * followed by a number in dpm (i.e., * 100 dpm) denotes direct probe readings in dpm/100 cm². # denotes dose rates in mR/hr.

PURPOSE: Unaffected area release survey

REMOVABLE CONTAMINATION

DATE: 12-7-94 LOCATION: Bausch & Lomb Storage Room

COUNTER: Ludlum 2220 (Model) 50067 (Number) EFFICIENCY: 0.0667 (Alpha) NA (Beta/Gamma)

LOCATION	DPM/100cm² βγ	DPM/100cm² α	LOCATION	DPM/100cm² βγ	DPM/100cm² α	LOCATION	DPM/100cm² βγ	DPM/100cm² α
1		< 69	21		< 69			
2		< 69	22		< 69			
3		< 69	23		< 69			
4		< 69	24		< 69			
5		< 69	25	NA	< 69			
6		< 69	26		< 69			
7		< 69	27		< 69			
8		< 69	28		< 69			
9		< 69	29		< 69			
10		< 69	30		< 69			
11	NA	< 69					NA	
12		< 69						
13		< 69						
14		< 69						
15		< 69		NA				
16		< 69						
17		< 69						
18		< 69						
19		< 69						
20		< 69						

ALPHA BKG COUNT RATE: 0 cpm

BETA/GAMMA BKG COUNT RATE: NA

α MDA (dpm/100cm²) 69

βγ MDA (dpm/100cm²) NA

SURVEYOR D. L. Vann for Kevin Gracezyk

SUPERVISOR B. Dale

REMOVABLE CONTAMINATION

DATE: 12-7-94 LOCATION: Bausch + Lomb Storage Room

COUNTER: Ludlum 2220 (Model) 50061 (Number) EFFICIENCY: N/A (Alpha) 0.238 (Beta/Gamma)

LOCATION	DPM/100cm² βγ	DPM/100cm² α	LOCATION	DPM/100cm² βγ	DPM/100cm² α	LOCATION	DPM/100cm² βγ	DPM/100cm² α
1	< 940		21	< 940				
2	< 940		22	< 940				
3	< 940		23	< 940				
4	< 940		24	< 940				
5	< 940		25	< 940				
6	< 940		26	< 940				
7	< 940		27	< 940				
8	< 940		28	< 940				
9	< 940		29	< 940				
10	< 940		30	< 940				
11	< 940							
12	< 940							
13	< 940							
14	< 940							
15	< 940							
16	< 940							
17	< 940							
18	< 940							
19	< 940							
20	< 940							

N/A

ALPHA BKG COUNT RATE: N/A

BETA/GAMMA BKG COUNT RATE: 44 cpm

α MDA (dpm/100cm²) N/A

βγ MDA (dpm/100cm²) 940

SURVEYOR D. L. Ugan

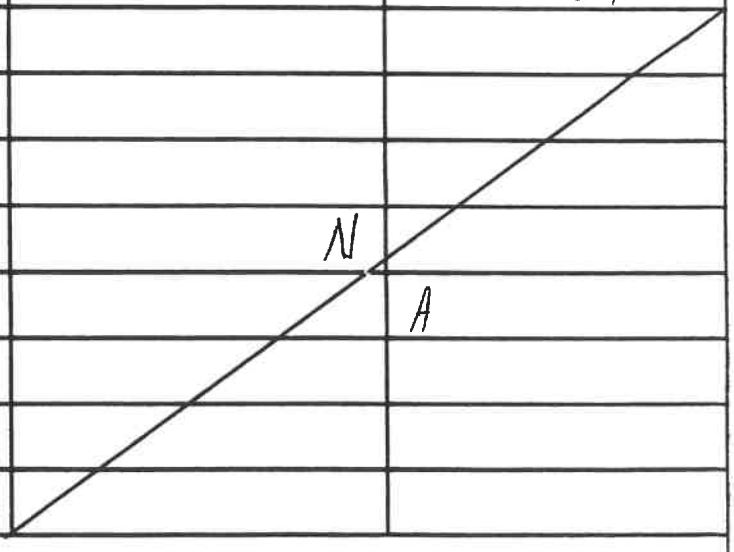
SUPERVISOR

AVERAGE CONTAMINATION SURVEY RESULTS

DATE: 12-7-94 LOCATION: Bausch Lomb storage area

INSTRUMENT: Ludlum 2220 50067 (MODEL / NUMBER) PROBE: AC-3 (MODEL) EFF: 0.0667

GRID NUMBER	dpm/100cm2	GRID NUMBER	dpm/100cm2
1	< 69	20	< 69
2	< 69	21	< 69
3	< 69	22	< 69
4	< 69	23	< 69
5	< 69	24	< 69
6	< 69	25	< 69
7	< 69	26	< 69
8	< 69	27	< 69
9	< 69	28	< 69
10	< 69	29	< 69
11	< 69	30	< 69
12	< 69		
13	< 69		
14	< 69		
15	< 69		
16	< 69		
17	< 69		
18	< 69		
19	< 69		



Average Background counts per minute 0 cpm

MDA (dpm/100cm 2) 69

*BASED ON AVERAGE OF 5 DIRECT MEASUREMENTS
(INITIAL DIRECT MEASUREMENT WAS GREATER THAN 60% OF GUIDELINE VALUE)

$$\frac{\text{dpm}}{100\text{cm}^2} = \frac{(\text{gross count rate}) - (\text{background count rate})}{(\text{efficiency})\ \frac{(\text{probe area})}{100\text{cm}^2}}$$

SURVEYOR P. L. Vann for Kevin Gracezyk

SUPERVISOR

AVERAGE CONTAMINATION SURVEY RESULTS

DATE: 12-7-94 LOCATION: Bausch & Lomb storage area

INSTRUMENT: Ludlum 2220 52836 (MODEL / NUMBER) PROBE: 44-9 (MODEL) EFF: 0.239

GRID NUMBER	dpm/100cm2	GRID NUMBER	dpm/100cm2
1	< 1360	20	< 1360
2	< 1360	21	< 1360
3	< 1360	22	< 1360
4	< 1360	23	< 1360
5	< 1360	24	< 1360
6	< 1360	25	2520
7	< 1360	26	< 1360
8	< 1360	27	< 1360
9	< 1360	28	< 1360
10	< 1360	29	< 1360
11	1680	30	< 1360
12	< 1360		
13	< 1360		
14	< 1360		
15	< 1360		
16	< 1360		
17	< 1360		
18	< 1360		
19	< 1360		

N

A

Average Background counts per minute 98

MDA (dpm/100cm 2) 1360

*BASED ON AVERAGE OF 5 DIRECT MEASUREMENTS
(INITIAL DIRECT MEASUREMENT WAS GREATER THAN 60% OF GUIDELINE VALUE)

$$\frac{\text{dpm}}{100\text{cm}^2} = \frac{(\text{gross count rate}) - (\text{background count rate})}{(\text{efficiency})\ \frac{(\text{probe area})}{100\text{cm}^2}}$$

SURVEYOR D. L. Vann for Kevin Graczyk

SUPERVISOR [signature]

EXPOSURE RATE SURVEY RESULTS

DATE: 12-7-94 LOCATION: Bausch & Lomb Storage Area

INSTRUMENT: Bicron B2184 CAL DUE: 10-14-95

GRID NUMBER	EXPOSURE RATE µR/h 1cm	1m	GRID NUMBER	EXPOSURE RATE µR/h 1cm	1m
1		5uR/hr	18		5uR/hr
2		5uR/hr	19		5uR/hr
3		5uR/hr	20		5uR/hr
4		5uR/hr	21		5uR/hr
5		5uR/hr	22		5uR/hr
6		5uR/hr	23		5uR/hr
7		5uR/hr	24	N/A	5uR/hr
8		5uR/hr	25		5uR/hr
9	N/A	5uR/hr	26		5uR/hr
10		5uR/hr	27		4uR/hr
11		6uR/hr	28		4uR/hr
12		6uR/hr	29		4uR/hr
13		5uR/hr	30		4uR/hr
14		5uR/hr			
15		5uR/hr	N		
16		6uR/hr		A	
17		6uR/hr			

MEASUREMENTS TAKEN AT 1cm AND/OR 1m ABOVE THE FLOOR.

BKG: 5uR/hr

SURVEYOR D. L. Evans

SUPERVISOR Bruce Lund

MDA CALCULATION SHEET

METER 2220 w/44-9 SERIAL #: 52836

TS: 1 TB: 1 RB: 98 cpm EFF: 0.239 PROBE SIZE: 15 cm²

$$MDA = \frac{2.71}{1} + 3.29\left(\frac{98}{1} + \frac{98}{1}\right)^{1/2}$$

$$\frac{}{0.239 \quad (15 / 100\ cm2)}$$

MDA = 1360 dpm/100cm²

METER 2220 w/AC-3 SERIAL #: 50067

TS: 1 TB: 1 RB: 0 cpm EFF: 0.0667 PROBE SIZE: 59 cm²

$$MDA = \frac{2.71}{1} + 3.29\left(\frac{0}{1} + \frac{0}{1}\right)^{1/2}$$

$$\frac{}{0.0667 \quad (59 / 100\ cm2)}$$

MDA = 69 dpm/100 cm²

METER 2220 w/44-9 SERIAL #: 50061

TS: 1 TB: 1 RB: 44 cpm EFF: 0.238 PROBE SIZE: 15 cm²

Removable only

$$MDA = \frac{2.71}{1} + 3.29\left(\frac{44}{1} + \frac{44}{1}\right)^{1/2}$$

$$\frac{}{0.238 \quad (15 / 100\ cm2)}$$

MDA = 940 dpm/100 cm².

METER _____ SERIAL #: _____

TS: _____ TB: _____ RB: _____ EFF: _____ PROBE SIZE: _____

$$MDA = \frac{2.71}{} + 3.29\left(\frac{}{} + \frac{}{}\right)^{1/2}$$

$$\frac{}{(\quad / 100\ cm2)}$$

MDA = _____

Technician: D. L. Vann Date: 12-7-94

Reviewed by: B Dale Date: 12-7-94

By:	Date:	Project:	2278-300
Chkd:	Date:	Page #:	

Bausch & Lomb Release Survey Data

Survey Unit: **Storage Area**

Activity (dpm/100cm^2)

Location Number	Removable α			Removable β–γ		
	Activity	Uncertainty *	MDA	Activity	Uncertainty *	MDA
1	69	16	69	940	64	940
2	69	16	69	940	64	940
3	69	16	69	940	64	940
4	69	16	69	940	64	940
5	69	16	69	940	64	940
6	69	16	69	940	64	940
7	69	16	69	940	64	940
8	69	16	69	940	64	940
9	69	16	69	940	64	940
10	69	16	69	940	64	940
11	69	16	69	940	64	940
12	69	16	69	940	64	940
13	69	16	69	940	64	940
14	69	16	69	940	64	940
15	69	16	69	940	64	940
16	69	16	69	940	64	940
17	69	16	69	940	64	940
18	69	16	69	940	64	940
19	69	16	69	940	64	940
20	69	16	69	940	64	940
21	69	16	69	940	64	940
22	69	16	69	940	64	940
23	69	16	69	940	64	940
24	69	16	69	940	64	940
25	69	16	69	940	64	940
26	69	16	69	940	64	940
27	69	16	69	940	64	940
28	69	16	69	940	64	940
29	69	16	69	940	64	940
30	69	16	69	940	64	940

* Uncertainties represent the 95% Confidence level, based on counting statistics.
When survey data indicated less than MDA, the MDA value was used in the calculation.

By:	Date:	Project:	2278-300
Chkd:	Date:	Page #:	

Bausch & Lomb Release Survey Data

Survey Unit: **Storage Area**

Activity (dpm/100cm^2)

Location Number	Direct α			Direct β–γ		
	Activity	Uncertainty *	MDA	Activity	Uncertainty *	MDA
1	69	16	69	1360	79	1360
2	69	16	69	1360	79	1360
3	69	16	69	1360	79	1360
4	69	16	69	1360	79	1360
5	69	16	69	1360	79	1360
6	69	16	69	1360	79	1360
7	69	16	69	1360	79	1360
8	69	16	69	1360	79	1360
9	69	16	69	1360	79	1360
10	69	16	69	1360	79	1360
11	69	16	69	1680	87	1360
12	69	16	69	1360	79	1360
13	69	16	69	1360	79	1360
14	69	16	69	1360	79	1360
15	69	16	69	1360	79	1360
16	69	16	69	1360	79	1360
17	69	16	69	1360	79	1360
18	69	16	69	1360	79	1360
19	69	16	69	1360	79	1360
20	69	16	69	1360	79	1360
21	69	16	69	1360	79	1360
22	69	16	69	1360	79	1360
23	69	16	69	1360	79	1360
24	69	16	69	1360	79	1360
25	69	16	69	2520	104	1360
26	69	16	69	1360	79	1360
27	69	16	69	1360	79	1360
28	69	16	69	1360	79	1360
29	69	16	69	1360	79	1360
30	69	16	69	1360	79	1360

* Uncertainties represent the 95% Confidence level, based on counting statistics.
When survey data indicated less than MDA, the MDA value was used in the calculation.

NINETY-FIVE PERCENT CONFIDENCE CALCULATION SHEET

Survey Unit Storage Room Date 12-7-94

Meter Ludlum 2220 Serial # 50067

Probe AC-3 Serial # 712582

MDA 69 dpm/100cm² Survey Type Removable α

Guideline Value 200 (dpm/100cm²)

Average Measurement Level

$$x_{ave} = \frac{1}{n_s} \sum_{i=1}^{n_s} x_i$$

where:

x_{ave}	=	calculated mean for a survey unit,
n_s	=	number of measurements within a survey unit,
x_i	=	systematic and random measurements at point (i)

Σx_i 2070 n_s 30 x_{ave} = 69

Standard Deviation

$$S_x = \sqrt{\frac{\sum_{i=1}^{n_s} (x_{ave} - x_i)^2}{n_s - 1}}$$

where:

S_x	=	standard deviation
n_s	=	number of measurements within a survey unit
x_i	=	systematic and random measurements at point (i)
x_{ave}	=	calculated mean for a survey unit

x_{ave} = 69 n_s = 30

$\Sigma (x_{ave} - x_i)^2$ = 0 s_x = 0

$$\mu_\alpha = x_{ave} + t_{1-\alpha,df} \frac{s_x}{\sqrt{n_s}},$$

where:

μ_α	=	value compared guideline value to determine 95% Confidence Level
x_{ave}	=	calculated mean for a survey unit,
$t_{1-\alpha,df}$	=	95% confidence level for n-1 degrees of freedom (from NUREG/CR-5849, Table B-1, "Factors for Comparison of Survey Data")
s_x	=	standard deviation of measurements in a survey unit, and
n_s	=	number of measurements within a survey unit used to determine x_{ave} and s_x.

x_{ave} = 69

$t_{1-\alpha,df}$ = 1.699

s_x = 0

n_s = 30

μ_α = 69

NOTE: When determining x_{ave}, only minimum detectable activity (MDA) values were available for some measurements locations; the MDA values were therefore used as actual activity levels for the purpose of performing this calculation.

The site specific guideline values for this project are 5000 dpm/100 cm² fixed plus removable and 1000 dpm/100 cm² removable for beta-gamma emitting nuclides, and 1000 dpm/100 cm² fixed plus removable and 200 for alpha emitting nuclides. If μ_α is less than the specific guideline value, the data for this survey unit satisfies the guideline at the 95% confidence level. If μ_α is greater than the specific guideline value, further remediation of the survey unit is necessary.

Individual Completing Form: D. L. Vann Date: 12-7-94

Reviewed By: R. Kyle Date: 1/10/95

NINETY-FIVE PERCENT CONFIDENCE CALCULATION SHEET

Survey Unit Storage Room Date 12-7-94

Meter Ludlum 2220 Serial # 50061

Probe 44-9 Serial # PR066761

MDA 940 dpm/100cm^2 Survey Type Removable β-γ

Guideline Value 1000 (dpm/100cm^2)

Average Measurement Level

$$x_{ave} = \frac{1}{n_s} \sum_{i=1}^{n_s} x_i$$

where:

x_{ave}	=	calculated mean for a survey unit,
n_s	=	number of measurements within a survey unit,
x_i	=	systematic and random measurements at point (i)

Σx_i 28,200 n_s 30 x_{ave} = 940

Standard Deviation

$$S_x = \sqrt{\frac{\sum_{i=1}^{n_s} (x_{ave} - x_i)^2}{n_s - 1}}$$

where:

S_x	=	standard deviation
n_s	=	number of measurements within a survey unit
x_i	=	systematic and random measurements at point (i)
x_{ave}	=	calculated mean for a survey unit

x_{ave} = 940 n_s = 30

$\Sigma (x_{ave} - x_i)^2$ = 0 S_x = 0

$$\mu_\alpha = x_{ave} + t_{1-\alpha,df} \frac{s_x}{\sqrt{n_s}},$$

where:

μ_α	=	value compared guideline value to determine 95% Confidence Level
x_{ave}	=	calculated mean for a survey unit,
$t_{1-\alpha,df}$	=	95% confidence level for n-1 degrees of freedom (from NUREG/CR-5849, Table B-1, "Factors for Comparison of Survey Data")
s_x	=	standard deviation of measurements in a survey unit, and
n_s	=	number of measurements within a survey unit used to determine x_{ave} and s_x.

x_{ave} = 940

$t_{1-\alpha,df}$ = 1,699

s_x = 0

n_s = 30

μ_α = 940

NOTE: When determining x_{ave}, only minimum detectable activity (MDA) values were available for some measurements locations; the MDA values were therefore used as actual activity levels for the purpose of performing this calculation.

The site specific guideline values for this project are 5000 dpm/100 cm² fixed plus removable and 1000 dpm/100 cm² removable for beta-gamma emitting nuclides, and 1000 dpm/100 cm² fixed plus removable and 200 for alpha emitting nuclides. If μ_α is less than the specific guideline value, the data for this survey unit satisfies the guideline at the 95% confidence level. If μ_α is greater than the specific guideline value, further remediation of the survey unit is necessary.

Individual Completing Form: D. L. Vann Date: 12-7-94

Reviewed By: R Kyle Date: 1/10/95

NINETY-FIVE PERCENT CONFIDENCE CALCULATION SHEET

Survey Unit Storage Area Date 12-7-94

Meter Ludlum 2220 Serial # 50067

Probe AC-3 Serial # 712582

MDA 69 dpm/100cm² Survey Type Direct α

Guideline Value 1000 (dpm/100cm²)

Average Measurement Level

$$x_{ave} = \frac{1}{n_s} \sum_{i=1}^{n_s} x_i$$

where:

x_{ave}	=	calculated mean for a survey unit,
n_s	=	number of measurements within a survey unit,
x_i	=	systematic and random measurements at point (i)

Σx_i 2070 n_s 30 x_{ave} = 69

Standard Deviation

$$S_x = \sqrt{\frac{\sum_{i=1}^{n_s} (x_{ave} - x_i)^2}{n_s - 1}}$$

where:

S_x	=	standard deviation
n_s	=	number of measurements within a survey unit
x_i	=	systematic and random measurements at point (i)
x_{ave}	=	calculated mean for a survey unit

x_{ave} = 69 n_s = 30

$\Sigma (x_{ave} - x_i)^2$ = 0 s_x = 0

$$\mu_\alpha = x_{ave} + t_{1-\alpha,df} \frac{s_x}{\sqrt{n_s}},$$

where:

μ_α	=	value compared guideline value to determine 95% Confidence Level
x_{ave}	=	calculated mean for a survey unit,
$t_{1-\alpha,df}$	=	95% confidence level for n-1 degrees of freedom (from NUREG/CR-5849, Table B-1, "Factors for Comparison of Survey Data")
s_x	=	standard deviation of measurements in a survey unit, and
n_s	=	number of measurements within a survey unit used to determine x_{ave} and s_x.

x_{ave} = 69

$t_{1-\alpha,df}$ = 1.699

s_x = 0

n_s = 30

μ_α = 69

NOTE: When determining x_{ave}, only minimum detectable activity (MDA) values were available for some measurements locations; the MDA values were therefore used as actual activity levels for the purpose of performing this calculation.

The site specific guideline values for this project are 5000 dpm/100 cm² fixed plus removable and 1000 dpm/100 cm² removable for beta-gamma emitting nuclides, and 1000 dpm/100 cm² fixed plus removable and 200 for alpha emitting nuclides. If μ_α is less than the specific guideline value, the data for this survey unit satisfies the guideline at the 95% confidence level. If μ_α is greater than the specific guideline value, further remediation of the survey unit is necessary.

Individual Completing Form: D. L. Vann Date: 12-7-94

Reviewed By: R Kyle Date: 1/10/95

NINETY-FIVE PERCENT CONFIDENCE CALCULATION SHEET

Survey Unit Storage Area Date 12-7-94

Meter Ludlum 2220 Serial # 52836

Probe 44-9 Serial # PRO 68918

MDA 1300 dpm/100cm² Survey Type Direct B-γ

Guideline Value 5000 (dpm/100cm²)

Average Measurement Level

$$x_{ave} = \frac{1}{n_s} \sum_{i=1}^{n_s} x_i$$

where:

x_{ave}	=	calculated mean for a survey unit,
n_s	=	number of measurements within a survey unit,
x_i	=	systematic and random measurements at point (i)

Σx_i 42,250 n_s 30 x_{ave} = 1409,3

Standard Deviation

$$S_x = \sqrt{\frac{\sum_{i=1}^{n_s} (x_{ave} - x_i)^2}{n_s - 1}}$$

where:

S_x	=	standard deviation
n_s	=	number of measurements within a survey unit
x_i	=	systematic and random measurements at point (i)
x_{ave}	=	calculated mean for a survey unit

x_{ave} = 1409,3 n_s = 30

$\Sigma (x_{ave} - x_i)^2$ = 1,374,987 S_x = 217,7

$$\mu_\alpha = x_{ave} + t_{1-\alpha,df} \frac{s_x}{\sqrt{n_s}},$$

where:

μ_α	=	value compared guideline value to determine 95% Confidence Level
x_{ave}	=	calculated mean for a survey unit,
$t_{1-\alpha,df}$	=	95% confidence level for n-1 degrees of freedom (from NUREG/CR-5849, Table B-1, "Factors for Comparison of Survey Data")
s_x	=	standard deviation of measurements in a survey unit, and
n_s	=	number of measurements within a survey unit used to determine x_{ave} and s_x.

x_{ave} = 1409.3

$t_{1-\alpha,df}$ = 1.699

s_x = 217.7

n_s = 30

μ_α = 1476.8

NOTE: When determining x_{ave}, only minimum detectable activity (MDA) values were available for some measurements locations; the MDA values were therefore used as actual activity levels for the purpose of performing this calculation.

The site specific guideline values for this project are 5000 dpm/100 cm^2 fixed plus removable and 1000 dpm/100 cm^2 removable for beta-gamma emitting nuclides, and 1000 dpm/100 cm^2 fixed plus removable and 200 for alpha emitting nuclides. If μ_α is less than the specific guideline value, the data for this survey unit satisfies the guideline at the 95% confidence level. If μ_α is greater than the specific guideline value, further remediation of the survey unit is necessary.

Individual Completing Form: D. L. Vann Date: 12-7-94

Reviewed By: R Kyle Date: 1/10/95

NINETY-FIVE PERCENT CONFIDENCE CALCULATION SHEET

Survey Unit Storage Area Date 12-7-94

Meter Bicron MicroRem Serial # B218L

Probe NA Serial # NA

MDA NA Survey Type Exposure

Guideline Value 10 uRem/hr ~~(dpm/100cm²)~~

Average Measurement Level

$$x_{ave} = \frac{1}{n_s} \sum_{i=1}^{n_s} x_i$$

where:

x_{ave}	=	calculated mean for a survey unit,
n_s	=	number of measurements within a survey unit,
x_i	=	systematic and random measurements at point (i)

Σx_i 150 n_s 30 x_{ave} = 5

Standard Deviation

$$S_x = \sqrt{\frac{\sum_{i=1}^{n_s} (x_{ave} - x_i)^2}{n_s - 1}}$$

where:

S_x	=	standard deviation
n_s	=	number of measurements within a survey unit
x_i	=	systematic and random measurements at point (i)
x_{ave}	=	calculated mean for a survey unit

x_{ave} = 5 n_s = 30

$\Sigma (x_{ave} - x_i)^2$ = 8 s_x = 0,5

$$\mu_\alpha = x_{ave} + t_{1-\alpha,df} \frac{s_x}{\sqrt{n_s}},$$

where:

μ_α	=	value compared guideline value to determine 95% Confidence Level
x_{ave}	=	calculated mean for a survey unit,
$t_{1-\alpha,df}$	=	95% confidence level for n-1 degrees of freedom (from NUREG/CR-5849, Table B-1, "Factors for Comparison of Survey Data")
s_x	=	standard deviation of measurements in a survey unit, and
n_s	=	number of measurements within a survey unit used to determine x_{ave} and s_x.

x_{ave} = 5

$t_{1-\alpha,df}$ = 1.699

s_x = 0.5

n_s = 30

μ_α = 5.2

NOTE: When determining x_{ave}, only minimum detectable activity (MDA) values were available for some measurements locations; the MDA values were therefore used as actual activity levels for the purpose of performing this calculation.

The site specific guideline values for this project are 5000 dpm/100 cm² fixed plus removable and 1000 dpm/100 cm² removable for beta-gamma emitting nuclides, and 1000 dpm/100 cm² fixed plus removable and 200 for alpha emitting nuclides. If μ_α is less than the specific guideline value, the data for this survey unit satisfies the guideline at the 95% confidence level. If μ_α is greater than the specific guideline value, further remediation of the survey unit is necessary.

Individual Completing Form: D. L. Vann Date: 12-7-94

Reviewed By: R. Kyle Date: 1/13/95

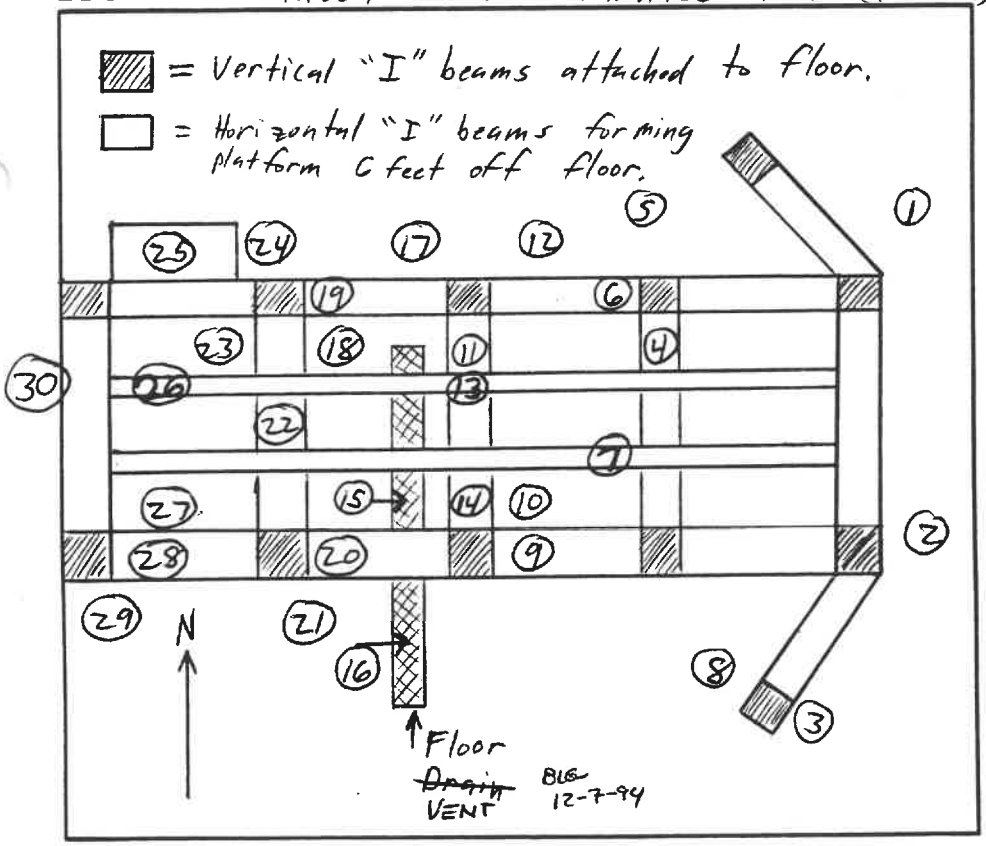
SURVEYOR D.L. Vann for Kevin Graczyk DATE 12-7-94

REVIEWER B Dale TIME 1000

SURVEY METERS

MODEL Ludlum 2220	MODEL Ludlum 2220	MODEL Bicron
SERIAL # 52836	SERIAL # 50067	SERIAL # B 2181
CAL DUE 10-17-95	CAL DUE 10-17-95	CAL DUE 10-14-95
EFFICIENCY 0.239	EFFICIENCY 0.0667	EFFICIENCY NA
TYPE 44-9	TYPE AC-3	TYPE Micro Rem
BKG 98 cpm	BKG 0 cpm	BKG 5 uRem/hr
MDA 1360 dpm/100cm²	MDA 69 dpm/100cm²	MDA NA

LOCATION: Bausch & Lomb Furnace Area (level 1)



SMEAR #	dpm/100 cm² βγ	dpm/100 cm² α
See attached		
	N	
	A	

NOTE: Smear results in dpm/100 cm² unless otherwise noted. (1) denotes smear location. An * followed by a number in dpm (i.e., * 100 dpm) denotes direct probe readings in dpm/100 cm². # denotes dose rates in mR/hr.

PURPOSE: Unaffected area release Survey

REMOVABLE CONTAMINATION

DATE: 12-7-94 LOCATION: Bausch & Lomb Furnace Area

COUNTER: Ludlum 2220 50067 (Model / Number) EFFICIENCY: 0.0667 (Alpha) NA (Beta/Gamma)

LOCATION	DPM/100cm² βγ	DPM/100cm² α	LOCATION	DPM/100cm² βγ	DPM/100cm² α	LOCATION	DPM/100cm² βγ	DPM/100cm² α
1		< 69	21		< 69			
2		< 69	22		< 69			
3		< 69	23		< 69			
4		< 69	24		< 69			
5		< 69	25	NA	< 69			
6		< 69	26		< 69			
7		< 69	27		< 69			
8		< 69	28		< 69			
9		< 69	29		< 69			
10		< 69	30		< 69			
11	NA	< 69					NA	
12		< 69						
13		< 69						
14		< 69						
15		< 69		NA				
16		< 69						
17		< 69						
18		< 69						
19		< 69						
20		< 69						

ALPHA BKG COUNT RATE: 0 cpm

BETA/GAMMA BKG COUNT RATE: NA

α MDA (dpm/100cm²) 69

βγ MDA (dpm/100cm²) NA

SURVEYOR D. L. Vann for Kevin Graczyk

SUPERVISOR B Dulo

REMOVABLE CONTAMINATION

DATE: 12-7-94 LOCATION: Bausch + Lomb Furnace Area

COUNTER: Ludlum 2220 (Model) 50061 ~~52036~~ (Number) EFFICIENCY: N/A (Alpha) 0.238 (Beta/Gamma)

LOCATION	DPM/100cm² βγ	DPM/100cm² α	LOCATION	DPM/100cm² βγ	DPM/100cm² α	LOCATION	DPM/100cm² βγ	DPM/100cm² α
1	<940		21	<940				
2	<940		22	<940				
3	<940		23	<940				
4	<940		24	<940				
5	<940		25	<940				
6	<940		26	<940				
7	<940		27	<940				
8	<940		28	<940				
9	<940	N/A	29	<940	N/A			
10	<940		30	<940				
11	<940							N/A
12	<940							
13	<940							
14	<940							
15	<940		N/A					
16	<940							
17	<940							
18	<940							
19	<940							
20	<940							

ALPHA BKG COUNT RATE: N/A

BETA/GAMMA BKG COUNT RATE: 44 cpm

α MDA (dpm/100cm²) N/A

βγ MDA (dpm/100cm²) 940

SURVEYOR Brenda Lowe

SUPERVISOR D. L. Lowe

AVERAGE CONTAMINATION SURVEY RESULTS

DATE: 12-7-94 LOCATION: Bausch & Lomb Furnace Area

INSTRUMENT: Ludlum 2220 (MODEL) 50067 (NUMBER) PROBE: AC-3 (MODEL) EFF: 0.0667

GRID NUMBER	dpm/100cm2	GRID NUMBER	dpm/100cm2
1	< 69	20	< 69
2	< 69	21	< 69
3	< 69	22	< 69
4	< 69	23	< 69
5	< 69	24	< 69
6	< 69	25	< 69
7	< 69	26	< 69
8	< 69	27	< 69
9	< 69	28	< 69
10	< 69	29	< 69
11	< 69	30	< 69
12	< 69		
13	< 69		
14	< 69		
15	< 69	N	
16	< 69	A	
17	< 69		
18	< 69		
19	< 69		

Average Background counts per minute 0

MDA (dpm/100cm 2) 69

*BASED ON AVERAGE OF 5 DIRECT MEASUREMENTS
(INITIAL DIRECT MEASUREMENT WAS GREATER THAN 60% OF GUIDELINE VALUE)

$$\frac{\text{dpm}}{100\text{cm}^2} = \frac{(\text{gross count rate}) - (\text{background count rate})}{(\text{efficiency})\ \frac{(\text{probe area})}{100\text{cm}^2}}$$

SURVEYOR D. L. Dunn for Kevin Graczyk

SUPERVISOR [signature]

AVERAGE CONTAMINATION SURVEY RESULTS

DATE: 12-7-94 LOCATION: Bausch & Lomb Furnace Area

INSTRUMENT: Ludlum 2220 52836 (MODEL / NUMBER) PROBE: 44-9 (MODEL) EFF: 0.239

GRID NUMBER	dpm/100cm2	GRID NUMBER	dpm/100cm2
1	< 1360	20	< 1360
2	< 1360	21	< 1360
3	< 1360	22	2800
4	< 1360	23	< 1360
5	< 1360	24	< 1360
6	< 1360	25	< 1360
7	< 1360	26	< 1360
8	< 1360	27	< 1360
9	< 1360	28	2520
10	< 1360	29	< 1360
11	3360	30	< 1360
12	< 1360		~~< 1360~~ OLV 1-2-95
13	< 1360		
14	2240		
15	2800	N	
16	3360		A
17	< 1360		
18	< 1360		
19	< 1360		

Average Background counts per minute 98

MDA (dpm/100cm 2) 1360

*BASED ON AVERAGE OF 5 DIRECT MEASUREMENTS
(INITIAL DIRECT MEASUREMENT WAS GREATER THAN 60% OF GUIDELINE VALUE)

$$\frac{\text{dpm}}{100\text{cm}^2} = \frac{(\text{gross count rate}) - (\text{background count rate})}{(\text{efficiency})\ \frac{(\text{probe area})}{100\text{cm}^2}}$$

SURVEYOR D. L. Vann for Kevin Graczyk

SUPERVISOR B Dulle

EXPOSURE RATE SURVEY RESULTS

DATE: 12-7-94 LOCATION: Bausch & Lomb Furnace Area

INSTRUMENT: Bicron B2184 CAL DUE: 10-14-95

GRID NUMBER	EXPOSURE RATE µR/h 1cm	1m	GRID NUMBER	EXPOSURE RATE µR/h 1cm	1m
1		5uR/hr	18		5uR/hr
2		5uR/hr	19		5uR/hr
3		5uR/hr	20		5uR/hr
4		5uR/hr	21		5uR/hr
5		5uR/hr	22		5uR/hr
6		5uR/hr	23		5uR/hr
7		5uR/hr	24	N/A	5uR/hr
8		4uR/hr	25		5uR/hr
9	N/A	4uR/hr	26		5uR/hr
10		4uR/hr	27		5uR/hr
11		5uR/hr	28		5uR/hr
12		5uR/hr	29		5uR/hr
13		5uR/hr	30		5uR/hr
14		5uR/hr			
15		5uR/hr	N		
16		5uR/hr	A		
17		5uR/hr			

MEASUREMENTS TAKEN AT 1cm AND/OR 1m ABOVE THE FLOOR.

BKG: 5uR/hr

SURVEYOR Kim R. Smith

SUPERVISOR Brandon Smith

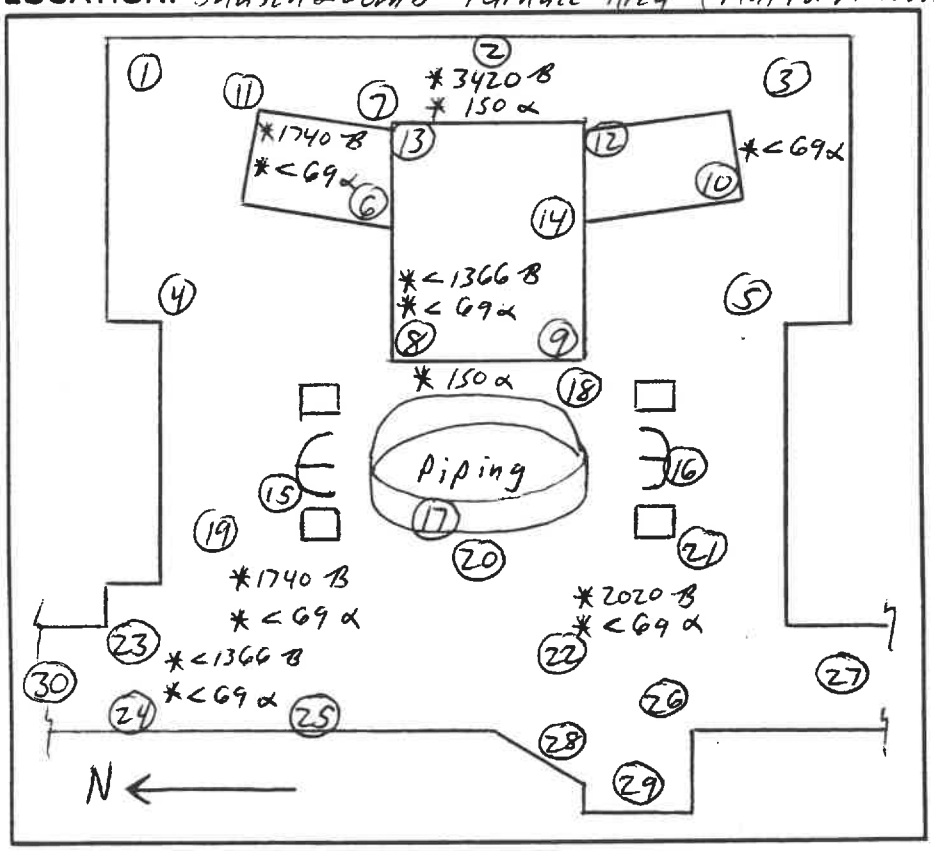
SURVEYOR D. L. Vann DATE 12-8-94

REVIEWER B Dunbar TIME 1000

SURVEY METERS

MODEL Ludlum 2220	MODEL Ludlum 2220	MODEL Bicron
SERIAL # 50061	SERIAL # 50067	SERIAL # B218L
CAL DUE 10-17-95	CAL DUE 10-17-95	CAL DUE 10-14-95
EFFICIENCY 0.238	EFFICIENCY 0.0667	EFFICIENCY NA
TYPE 44-9	TYPE AC-3	TYPE MicroRem
BKG 98 cpm	BKG 0 cpm	BKG 5mR/hr
MDA 1366 dpm/100cm²	MDA 69 dpm/100cm²	MDA NA

LOCATION: Bausch & Lomb Furnace Area (Platform level 2)



SMEAR #	dpm/100 cm² βγ	dpm/100 cm² α
1	<940	<69
2	<940	<69
3	<940	<69
4	<940	<69
5	<940	<69
6	<940	<69
7	<940	<69
8	<940	<69
9	<940	<69
10	<940	<69
11	<940	<69
12	<940	<69
13	<940	<69
14	<940	<69
15	<940	<69
16	<940	<69
17	<940	<69
18	<940	<69
19	<940	<69
20	<940	<69

NOTE: Smear results in dpm/100 cm² unless otherwise noted. (1) denotes smear location. An * followed by a number in dpm (i.e., * 100 dpm) denotes direct probe readings in dpm/100 cm². # denotes dose rates in mR/hr.

PURPOSE: Unaffected area release survey

SURVEYOR D. L. Vann DATE 12-8-94

REVIEWER [signature] TIME 1000

SURVEY METERS

MODEL	See page 7	See page 7	See page 7
SERIAL #			
CAL DUE	N/A	N/A	N/A
EFFICIENCY			
TYPE			
BKG			
MDA			

LOCATION:

See page 7

SMEAR #	dpm/100 cm² βγ	dpm/100 cm² α
21	<940	<69
22	<940	<69
23	<940	<69
24	<940	<69
25	<940	<69
26	<940	<69
27	<940	<69
28	<940	<69
29	<940	<69
30	<940	<69
	N	
	A	

NOTE: Smear results in dpm/100 cm² unless otherwise noted. (1) denotes smear location. An * followed by a number in dpm (i.e., * 100 dpm) denotes direct probe readings in dpm/100 cm². # denotes dose rates in mR/hr.

PURPOSE: continuation of sheet 7

MDA CALCULATION SHEET

METER 2220 w/44-9 SERIAL #: 52836

TS: 1 TB: 1 RB: 98 cpm EFF: 0.239 PROBE SIZE: 15 cm²

$$MDA = \frac{2.71/1 + 3.29(98/1 + 98/1)^{1/2}}{0.239 \times (15/100\ cm^2)}$$

MDA = 1360 dpm/100cm²

METER 2220 w/44-9 SERIAL #: 50061

TS: 1 TB: 1 RB: 98 cpm EFF: 0.238 PROBE SIZE: 15 cm²

$$MDA = \frac{2.71/1 + 3.29(98/1 + 98/1)^{1/2}}{0.238 \times (15/100\ cm^2)}$$

MDA = 1366 dpm/100cm²

METER 2220 w/Ac-3 SERIAL #: 50067

TS: 1 TB: 1 RB: 0 cpm EFF: 0.0667 PROBE SIZE: 59 cm²

$$MDA = \frac{2.71/1 + 3.29(0/1 + 0/1)^{1/2}}{0.0667 \times (59/100\ cm^2)}$$

MDA = 69 dpm/100cm²

METER 2220 w/44-9 SERIAL #: 50061

TS: 1 TB: 1 RB: 44 cpm EFF: 0.238 PROBE SIZE: 15 cm²

$$MDA = \frac{2.71/1 + 3.29(44/1 + 44/1)^{1/2}}{0.238 \times (15/100\ cm^2)}$$

MDA = 940 dpm/100cm²

Removable only

Technician: D. L. Yanz Date: 12-7-94

Reviewed by: B Dula Date: 12-7-94

By:	Date:	Project:	2278-300
Chkd:	Date:	Page #:	

Bausch & Lomb Release Survey Data

Survey Unit: **Furnace Area**

Activity (dpm/100cm^2)

Location Number	Removable α			Removable β–γ		
	Activity	Uncertainty *	MDA	Activity	Uncertainty *	MDA
1	69	16	69	940	64	940
2	69	16	69	940	64	940
3	69	16	69	940	64	940
4	69	16	69	940	64	940
5	69	16	69	940	64	940
6	69	16	69	940	64	940
7	69	16	69	940	64	940
8	69	16	69	940	64	940
9	69	16	69	940	64	940
10	69	16	69	940	64	940
11	69	16	69	940	64	940
12	69	16	69	940	64	940
13	69	16	69	940	64	940
14	69	16	69	940	64	940
15	69	16	69	940	64	940
16	69	16	69	940	64	940
17	69	16	69	940	64	940
18	69	16	69	940	64	940
19	69	16	69	940	64	940
20	69	16	69	940	64	940
21	69	16	69	940	64	940
22	69	16	69	940	64	940
23	69	16	69	940	64	940
24	69	16	69	940	64	940
25	69	16	69	940	64	940
26	69	16	69	940	64	940
27	69	16	69	940	64	940
28	69	16	69	940	64	940
29	69	16	69	940	64	940
30	69	16	69	940	64	940

* Uncertainties represent the 95% Confidence level, based on counting statistics.
When survey data indicated less than MDA, the MDA value was used in the calculation.

By:	Date:	Project:	2278-300
Chkd:	Date:	Page #:	

Bausch & Lomb Release Survey Data

Survey Unit: **Furnace Area**

Activity (dpm/100cm^2)

Location Number	Direct α			Direct β–γ		
	Activity	Uncertainty *	MDA	Activity	Uncertainty *	MDA
1	69	16	69	1360	79	1360
2	69	16	69	1360	79	1360
3	69	16	69	1360	79	1360
4	69	16	69	1360	79	1360
5	69	16	69	1360	79	1360
6	69	16	69	1360	79	1360
7	69	16	69	1360	79	1360
8	69	16	69	1360	79	1360
9	69	16	69	1360	79	1360
10	69	16	69	1360	79	1360
11	69	16	69	3360	118	1360
12	69	16	69	1360	79	1360
13	69	16	69	1360	79	1360
14	69	16	69	2240	98	1360
15	69	16	69	2800	109	1360
16	69	16	69	3360	118	1360
17	69	16	69	1360	79	1360
18	69	16	69	1360	79	1360
19	69	16	69	1360	79	1360
20	69	16	69	1360	79	1360
21	69	16	69	1360	79	1360
22	69	16	69	2800	109	1360
23	69	16	69	1360	79	1360
24	69	16	69	1360	79	1360
25	69	16	69	1360	79	1360
26	69	16	69	1360	79	1360
27	69	16	69	1360	79	1360
28	69	16	69	2520	104	1360
29	69	16	69	1360	79	1360
30	69	16	69	1360	79	1360

* Uncertainties represent the 95% Confidence level, based on counting statistics.
When survey data indicated less than MDA, the MDA value was used in the calculation.

NINETY-FIVE PERCENT CONFIDENCE CALCULATION SHEET

level 1

Survey Unit furnace Area Date 12-7-94

Meter Ludlum 2220 Serial # 50067

Probe Ac-3 Serial # 712582

MDA 69 dpm/100cm² Survey Type Removable

Guideline Value 200 (dpm/100cm²)

Average Measurement Level

$$x_{ave} = \frac{1}{n_s} \sum_{i=1}^{n_s} x_i$$

where:

x_{ave}	=	calculated mean for a survey unit,
n_s	=	number of measurements within a survey unit,
x_i	=	systematic and random measurements at point (i)

Σx_i 2070 n_s 30 x_{ave} = 69

Standard Deviation

$$S_x = \sqrt{\frac{\sum_{i=1}^{n_s} (x_{ave} - x_i)^2}{n_s - 1}}$$

where:

S_x	=	standard deviation
n_s	=	number of measurements within a survey unit
x_i	=	systematic and random measurements at point (i)
x_{ave}	=	calculated mean for a survey unit

x_{ave} = 69 n_s = 30

$\Sigma (x_{ave} - x_i)^2$ = 0 s_x = 0

$$\mu_\alpha = x_{ave} + t_{1-\alpha,df} \frac{s_x}{\sqrt{n_s}},$$

where:

μ_α	=	value compared guideline value to determine 95% Confidence Level
x_{ave}	=	calculated mean for a survey unit,
$t_{1-\alpha,df}$	=	95% confidence level for n-1 degrees of freedom (from NUREG/CR-5849, Table B-1, "Factors for Comparison of Survey Data")
s_x	=	standard deviation of measurements in a survey unit, and
n_s	=	number of measurements within a survey unit used to determine x_{ave} and s_x.

x_{ave} = 69

$t_{1-\alpha,df}$ = 1.740

s_x = 0

n_s = 18

μ_α = 69

NOTE: When determining x_{ave}, only minimum detectable activity (MDA) values were available for some measurements locations; the MDA values were therefore used as actual activity levels for the purpose of performing this calculation.

The site specific guideline values for this project are 5000 dpm/100 cm^2 fixed plus removable and 1000 dpm/100 cm^2 removable for beta-gamma emitting nuclides, and 1000 dpm/100 cm^2 fixed plus removable and 200 dpm/100 cm^2 removable for alpha emitting nuclides. If μ_α is less than the specific guideline value, the data for this survey unit satisfies the guideline at the 95% confidence level. If μ_α is greater than the specific guideline value, further remediation of the survey unit is necessary.

Individual Completing Form: S. Allen Date: 1-10-95

Reviewed By: R. Kyle Date: 1/13/95

NINETY-FIVE PERCENT CONFIDENCE CALCULATION SHEET

Survey Unit Batch Room N. Wall Date 12-11-94

Meter Ludlum 2220 Serial # 50061

Probe 44-9 Serial # PRO 66761

MDA 940 (dpm/100cm^2) Survey Type removable B-8

Guideline Value 1600 (dpm/100cm^2)

Average Measurement Level

$$x_{ave} = \frac{1}{n_s} \sum_{i=1}^{n_s} x_i$$

where:

x_{ave}	=	calculated mean for a survey unit,
n_s	=	number of measurements within a survey unit,
x_i	=	systematic and random measurements at point (i)

Σx_i 16920 n_s 18 x_{ave} = 940

Standard Deviation

$$S_x = \sqrt{\frac{\sum_{i=1}^{n_s} (x_{ave} - x_i)^2}{n_s - 1}}$$

where:

S_x	=	standard deviation
n_s	=	number of measurements within a survey unit
x_i	=	systematic and random measurements at point (i)
x_{ave}	=	calculated mean for a survey unit

x_{ave} = 940 n_s = 18

$\Sigma (x_{ave} - x_i)^2$ = 0 s_x = 0

$$\mu_\alpha = x_{ave} + t_{1-\alpha,df} \frac{s_x}{\sqrt{n_s}},$$

where:

μ_α	=	value compared guideline value to determine 95% Confidence Level
x_{ave}	=	calculated mean for a survey unit,
$t_{1-\alpha,df}$	=	95% confidence level for n-1 degrees of freedom (from NUREG/CR-5849, Table B-1, "Factors for Comparison of Survey Data")
s_x	=	standard deviation of measurements in a survey unit, and
n_s	=	number of measurements within a survey unit used to determine x_{ave} and s_x.

x_{ave} = 940

$t_{1-\alpha,df}$ = 1.740

s_x = 0

n_s = 18

μ_α = 940

NOTE: When determining x_{ave}, only minimum detectable activity (MDA) values were available for some measurements locations; the MDA values were therefore used as actual activity levels for the purpose of performing this calculation.

The site specific guideline values for this project are 5000 dpm/100 cm^2 fixed plus removable and 1000 dpm/100 cm^2 removable for beta-gamma emitting nuclides, and 1000 dpm/100 cm^2 fixed plus removable and 200 dpm/100 cm^2 removable for alpha emitting nuclides. If μ_α is less than the specific guideline value, the data for this survey unit satisfies the guideline at the 95% confidence level. If μ_α is greater than the specific guideline value, further remediation of the survey unit is necessary.

Individual Completing Form: S. Adler Date: 1-10-95

Reviewed By: R. Kyle Date: 1/13/95

NINETY-FIVE PERCENT CONFIDENCE CALCULATION SHEET

Survey Unit Batch Room N. Wall Date 12-11-94

Meter Ludlum 2220 Serial # 50067

Probe AC-3 Serial # 712582

MDA 69 (dpm/100cm^2) Survey Type direct ∝

Guideline Value 1000 (dpm/100cm^2)

Average Measurement Level

$$x_{ave} = \frac{1}{n_s} \sum_{i=1}^{n_s} x_i$$

where:

x_{ave}	=	calculated mean for a survey unit,
n_s	=	number of measurements within a survey unit,
x_i	=	systematic and random measurements at point (i)

Σx_i 1242 n_s 18 x_{ave} = 69

Standard Deviation

$$S_x = \sqrt{\frac{\sum_{i=1}^{n_s} (x_{ave} - x_i)^2}{n_s - 1}}$$

where:

S_x	=	standard deviation
n_s	=	number of measurements within a survey unit
x_i	=	systematic and random measurements at point (i)
x_{ave}	=	calculated mean for a survey unit

x_{ave} = 69 n_s = 18

$\Sigma (x_{ave} - x_i)^2$ = 0 s_x = 0

$$\mu_\alpha = x_{ave} + t_{1-\alpha,df} \frac{s_x}{\sqrt{n_s}},$$

where:

μ_α	=	value compared guideline value to determine 95% Confidence Level
x_{ave}	=	calculated mean for a survey unit,
$t_{1-\alpha,df}$	=	95% confidence level for n-1 degrees of freedom (from NUREG/CR-5849, Table B-1, "Factors for Comparison of Survey Data")
s_x	=	standard deviation of measurements in a survey unit, and
n_s	=	number of measurements within a survey unit used to determine x_{ave} and s_x.

x_{ave} = 69

$t_{1-\alpha,df}$ = 1.740

s_x = 0

n_s = 18

μ_α = 69

NOTE: When determining x_{ave}, only minimum detectable activity (MDA) values were available for some measurements locations; the MDA values were therefore used as actual activity levels for the purpose of performing this calculation.

The site specific guideline values for this project are 5000 dpm/100 cm^2 fixed plus removable and 1000 dpm/100 cm^2 removable for beta-gamma emitting nuclides, and 1000 dpm/100 cm^2 fixed plus removable and 200 dpm/100 cm^2 removable for alpha emitting nuclides. If μ_α is less than the specific guideline value, the data for this survey unit satisfies the guideline at the 95% confidence level. If μ_α is greater than the specific guideline value, further remediation of the survey unit is necessary.

Individual Completing Form: J. Allen Date: 1/10/95

Reviewed By: R. Knight Date: 1/13/95

NINETY-FIVE PERCENT CONFIDENCE CALCULATION SHEET

Survey Unit Batch Room N. Wall Date 12/11/94

Meter Ludlum 2220 Serial # 50061

Probe 44-9 Serial # PRO 66761

MDA 1366 (dpm/100cm^2) Survey Type direct β-γ

Guideline Value 5000 (dpm/100cm^2)

Average Measurement Level

$$x_{ave} = \frac{1}{n_s} \sum_{i=1}^{n_s} x_i$$

where:

x_{ave}	=	calculated mean for a survey unit,
n_s	=	number of measurements within a survey unit,
x_i	=	systematic and random measurements at point (i)

Σx_i 24588 n_s 18 x_{ave} = 1366

Standard Deviation

$$S_x = \sqrt{\frac{\sum_{i=1}^{n_s} (x_{ave} - x_i)^2}{n_s - 1}}$$

where:

S_x	=	standard deviation
n_s	=	number of measurements within a survey unit
x_i	=	systematic and random measurements at point (i)
x_{ave}	=	calculated mean for a survey unit

x_{ave} = 1366 n_s = 18

$\Sigma (x_{ave} - x_i)^2$ = 0 s_x = 0

$$\mu_\alpha = x_{ave} + t_{1-\alpha,df} \frac{s_x}{\sqrt{n_s}},$$

where:

μ_α	=	value compared guideline value to determine 95% Confidence Level
x_{ave}	=	calculated mean for a survey unit,
$t_{1-\alpha,df}$	=	95% confidence level for n-1 degrees of freedom (from NUREG/CR-5849, Table B-1, "Factors for Comparison of Survey Data")
s_x	=	standard deviation of measurements in a survey unit, and
n_s	=	number of measurements within a survey unit used to determine x_{ave} and s_x.

x_{ave} = 1366

$t_{1-\alpha,df}$ = 1.740

s_x = 0

n_s = 18

μ_α = 1366

NOTE: When determining x_{ave}, only minimum detectable activity (MDA) values were available for some measurements locations; the MDA values were therefore used as actual activity levels for the purpose of performing this calculation.

The site specific guideline values for this project are 5000 dpm/100 cm^2 fixed plus removable and 1000 dpm/100 cm^2 removable for beta-gamma emitting nuclides, and 1000 dpm/100 cm^2 fixed plus removable and 200 dpm/100 cm^2 removable for alpha emitting nuclides. If μ_α is less than the specific guideline value, the data for this survey unit satisfies the guideline at the 95% confidence level. If μ_α is greater than the specific guideline value, further remediation of the survey unit is necessary.

Individual Completing Form: J. Allen Date: 1/10/95

Reviewed By: R. Knight Date: 1/13/95

NINETY-FIVE PERCENT CONFIDENCE CALCULATION SHEET

Survey Unit Batch Room N. Wall Date 12-11-94

Meter Bicron Serial # B218L

Probe NA Serial # NA

MDA NA (dpm/100cm^2) Survey Type Exposure

Guideline Value 10 mRem/hr ~~(dpm/100cm^2)~~ BJB 1-13-95

Average Measurement Level

$$x_{ave} = \frac{1}{n_s} \sum_{i=1}^{n_s} x_i$$

where:

x_{ave}	=	calculated mean for a survey unit,
n_s	=	number of measurements within a survey unit,
x_i	=	systematic and random measurements at point (i)

Σx_i 93 n_s 18 x_{ave} = 5.2

Standard Deviation

$$S_x = \sqrt{\frac{\sum_{i=1}^{n_s} (x_{ave} - x_i)^2}{n_s - 1}}$$

where:

S_x	=	standard deviation
n_s	=	number of measurements within a survey unit
x_i	=	systematic and random measurements at point (i)
x_{ave}	=	calculated mean for a survey unit

x_{ave} = 5.2 n_s = 18

$\Sigma (x_{ave} - x_i)^2$ = 2.5 s_x = 0.4

$$\mu_\alpha = x_{ave} + t_{1-\alpha,df} \frac{s_x}{\sqrt{n_s}},$$

where:

μ_α	=	value compared guideline value to determine 95% Confidence Level
x_{ave}	=	calculated mean for a survey unit,
$t_{1-\alpha,df}$	=	95% confidence level for n-1 degrees of freedom (from NUREG/CR-5849, Table B-1, "Factors for Comparison of Survey Data")
s_x	=	standard deviation of measurements in a survey unit, and
n_s	=	number of measurements within a survey unit used to determine x_{ave} and s_x.

x_{ave} = 5.2

$t_{1-\alpha,df}$ = 1.740

s_x = 0.4

n_s = 18

μ_α = 5.3

NOTE: When determining x_{ave}, only minimum detectable activity (MDA) values were available for some measurements locations; the MDA values were therefore used as actual activity levels for the purpose of performing this calculation.

The site specific guideline values for this project are 5000 dpm/100 cm^2 fixed plus removable and 1000 dpm/100 cm^2 removable for beta-gamma emitting nuclides, and 1000 dpm/100 cm^2 fixed plus removable and 200 dpm/100 cm^2 removable for alpha emitting nuclides. If μ_α is less than the specific guideline value, the data for this survey unit satisfies the guideline at the 95% confidence level. If μ_α is greater than the specific guideline value, further remediation of the survey unit is necessary.

Individual Completing Form: O. L. Vann Date: 12-11-94

Reviewed By: R. Knight Date: 1/13/95

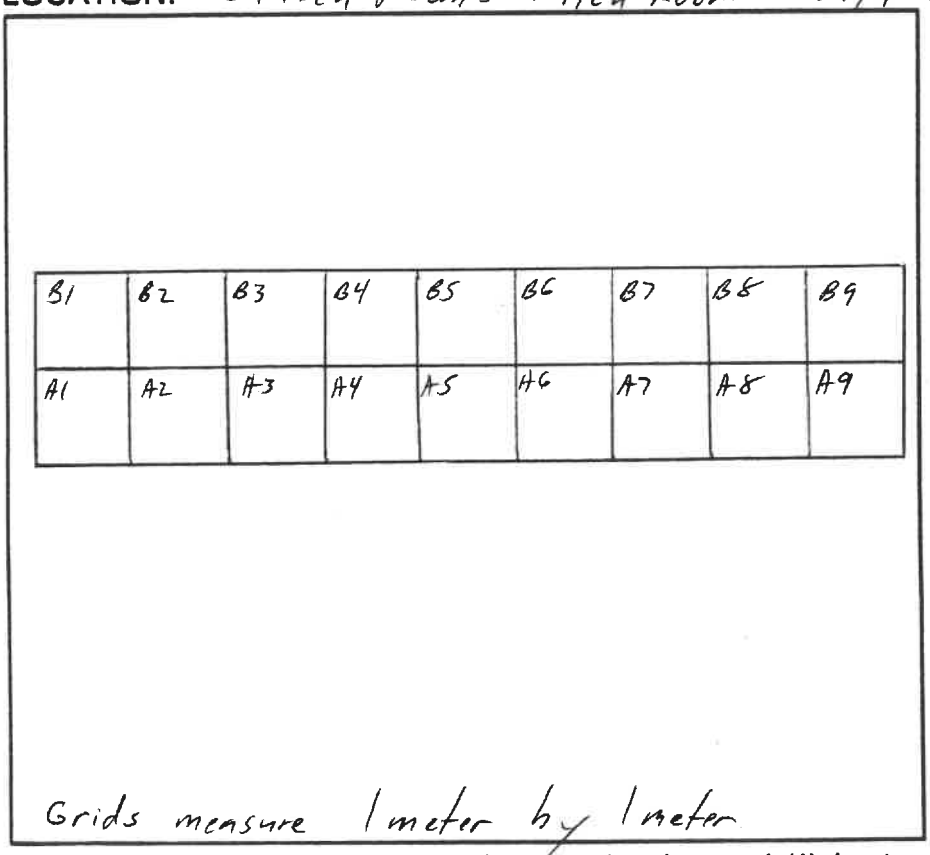
SURVEYOR D. L. Vann for Kevin Graczyk DATE 12-11-94

REVIEWER [signature] TIME 1530

SURVEY METERS

MODEL Ludlum 2220	MODEL Ludlum 2220	MODEL Bicron
SERIAL # 50061	SERIAL # 50067	SERIAL # B218L
CAL DUE 10-17-95	CAL DUE 10-17-95	CAL DUE 10-14-95
EFFICIENCY 0.238	EFFICIENCY 0.0667	EFFICIENCY NA
TYPE 44-9	TYPE AC-3	TYPE MicroRem
BKG 98 cpm	BKG 0 cpm	BKG 5 mRem/hr
MDA 1366 dpm/100cm²	MDA 69 dpm/100cm²	MDA NA

LOCATION: Bausch & Lomb Batch Room South wall



SMEAR #	dpm/100 cm² βγ	dpm/100 cm² α
	N	
	A	

NOTE: Smear results in dpm/100 cm² unless otherwise noted. (1) denotes smear location. An * followed by a number in dpm (i.e., * 100 dpm) denotes direct probe readings in dpm/100 cm². # denotes dose rates in mR/hr.

PURPOSE: Free Release Survey

REMOVABLE CONTAMINATION

DATE: 12-11-94

LOCATION: Bausch & Lomb Batch Room South wall

COUNTER: Ludlum 2220 (Model) 50061 (Number)

EFFICIENCY: 0.0667 (Alpha) 0.238 (Beta/Gamma)

LOCATION	DPM/100cm² βγ	DPM/100cm² α	LOCATION	DPM/100cm² βγ	DPM/100cm² α	LOCATION	DPM/100cm² βγ	DPM/100cm² α
A1	< 940	< 69						
A2	< 940	< 69						
A3	< 940	< 69						
A4	< 940	< 69						
A5	< 940	< 69						
A6	< 940	< 69						
A7	< 940	< 69						
A8	< 940	< 69						
A9	< 940	< 69						
B1	< 940	< 69						
B2	< 940	< 69						
B3	< 940	< 69						
B4	< 940	< 69						
B5	< 940	< 69						
B6	< 940	< 69						
B7	< 940	< 69						
B8	< 940	< 69						
B9	< 940	< 69						
	N			N			N	
	A			A			A	

ALPHA BKG COUNT RATE: 0 cpm

BETA/GAMMA BKG COUNT RATE: 44 cpm

α MDA (dpm/100cm²) 69

βγ MDA (dpm/100cm²) 940

SURVEYOR D. L. Vann

SUPERVISOR

AVERAGE CONTAMINATION SURVEY RESULTS

DATE: 12-11-94 LOCATION: Bausch + Lomb Batch Room South Wall

INSTRUMENT: Ludlum 2220 50067 (MODEL / NUMBER) PROBE: AC-3 (MODEL) EFF: 0.0667

GRID NUMBER	dpm/100cm2	GRID NUMBER	dpm/100cm2
A1	< 69		
A2	< 69		
A3	< 69		
A4	* 276		
A5	< 69		
A6	* 164		
A7	< 69		
A8	< 69		
A9	< 69		
B1	< 69		
B2	< 69		
B3	< 69		
B4	< 69		
B5	< 69		
B6	< 69		
B7	< 69		
B8	< 69		
B9	< 69		
N	A		

Average Background counts per minute 0

MDA (dpm/100cm 2) 69

*BASED ON AVERAGE OF 5 DIRECT MEASUREMENTS
(INITIAL DIRECT MEASUREMENT WAS GREATER THAN 60% OF GUIDELINE VALUE)

$$\frac{\text{dpm}}{100\text{cm}^2} = \frac{(\text{gross count rate}) - (\text{background count rate})}{(\text{efficiency})\ \frac{(\text{probe area})}{100\text{cm}^2}}$$

SURVEYOR D. L. Vann for Kevin Graczyk

SUPERVISOR [signature]

AVERAGE CONTAMINATION SURVEY RESULTS

DATE: 12-11-94 LOCATION: Bausch & Lomb Batch Room South Wall

INSTRUMENT: Ludlum 2200 50061 (MODEL / NUMBER) PROBE: 44-9 (MODEL) EFF: 0.238

GRID NUMBER	dpm/100cm2	GRID NUMBER	dpm/100cm2
A1	< 1366		
A2	< 1366		
A3	< 1366		
A4	* < 1366		
A5	* < 1366		
A6	* < 1366		
A7	< 1366		
A8	* < 1366		
A9	< 1366		
B1	< 1366		
B2	< 1366		
B3	< 1366		
B4	< 1366		
B5	< 1366		
B6	< 1366		
B7	< 1366		
B8	< 1366		
B9	< 1366		
N	A		

Average Background counts per minute 98

MDA (dpm/100cm 2) 1366

*BASED ON AVERAGE OF 5 DIRECT MEASUREMENTS
(INITIAL DIRECT MEASUREMENT WAS GREATER THAN 60% OF GUIDELINE VALUE)

$$\frac{\text{dpm}}{100\text{cm}^2} = \frac{(\text{gross count rate}) - (\text{background count rate})}{(\text{efficiency})\ \frac{(\text{probe area})}{100\text{cm}^2}}$$

SURVEYOR Kim R. Dunn

SUPERVISOR Brandon Dunn

EXPOSURE RATE SURVEY RESULTS

DATE: 12-11-94 LOCATION: Bausch & Lomb Batch Room South Wall

INSTRUMENT: Bicron B2186 CAL DUE: 10-14-95

GRID NUMBER	EXPOSURE RATE µR/h 1cm	1m	GRID NUMBER	EXPOSURE RATE µR/h 1cm	1m
A1		7 µR/hr			
A2		7 µR/hr			
A3		7 µR/hr			
A4		7 µR/hr			
A5		7 µR/hr			
A6		8 µR/hr			
A7		7 µR/hr			
A8		6 µR/hr			
A9	N/A	6 µR/hr	N		
B1		6 µR/hr	A		
B2		6 µR/hr			
B3		6 µR/hr			
B4		7 µR/hr			
B5		7 µR/hr			
B6		7 µR/hr			
B7		6 µR/hr			
B8		6 µR/hr			
B9		6 µR/hr			

MEASUREMENTS TAKEN AT 1cm AND/OR 1m ABOVE THE FLOOR.

BKG: 7 µR/hr

SURVEYOR [signature]

SUPERVISOR [signature]

MDA CALCULATION SHEET

METER 2220 w/44-9 SERIAL #: 50061

TS: 1 TB: 1 RB: 98 cpm EFF: 0.238 PROBE SIZE: 15 cm²

$$MDA = \frac{2.71/1 + 3.29\left(\frac{98}{1} + \frac{98}{1}\right)^{1/2}}{0.238\ (\ 15\ /\ 100\ cm2)}$$

MDA = 1366 dpm/100cm²

METER 2220 w/Hc-3 SERIAL #: 50067

TS: 1 TB: 1 RB: 0 cpm EFF: 0.0667 PROBE SIZE: 59 cm²

$$MDA = \frac{2.71/1 + 3.29\left(\frac{0}{1} + \frac{0}{1}\right)^{1/2}}{0.0667\ (\ 59\ /\ 100\ cm2)}$$

MDA = 69 dpm/100cm²

METER 2220 w/44-9 SERIAL #: 50061

TS: 1 TB: 1 RB: 44 cpm EFF: 0.238 PROBE SIZE: 15 cm²

$$MDA = \frac{2.71/1 + 3.29\left(\frac{44}{1} + \frac{44}{1}\right)^{1/2}}{0.238\ (\ 15\ /\ 100\ cm2)}$$

Removable only

MDA = 940 dpm/100cm².

METER _____ SERIAL #: _____

TS: _____ TB: _____ RB: _____ EFF: _____ PROBE SIZE: _____

$$MDA = \frac{2.71/1 + 3.29\left(\frac{\quad}{1} + \frac{\quad}{1}\right)^{1/2}}{(\quad / 100\ cm2)}$$

MDA = _____

Technician: D. L. Vann Date: 12-11-94

Reviewed by: [signature] Date: 12-11-94

By:	Date:	Project:	2278-300
Chkd:	Date:	Page #:	

Bausch & Lomb Release Survey Data

Survey Unit: **Batch Room South Wall**

Activity (dpm/100cm^2)

	Removable α			Removable β–γ		
Grid No.	Activity	Uncertainty *	MDA	Activity	Uncertainty *	MDA
A- 1	69	16	69	940	64	940
A- 2	69	16	69	940	64	940
A- 3	69	16	69	940	64	940
A- 4	69	16	69	940	64	940
A- 5	69	16	69	940	64	940
A- 6	69	16	69	940	64	940
A- 7	69	16	69	940	64	940
A- 8	69	16	69	940	64	940
A- 9	69	16	69	940	64	940
B- 1	69	16	69	940	64	940
B- 2	69	16	69	940	64	940
B- 3	69	16	69	940	64	940
B- 4	69	16	69	940	64	940
B- 5	69	16	69	940	64	940
B- 6	69	16	69	940	64	940
B- 7	69	16	69	940	64	940
B- 8	69	16	69	940	64	940
B- 9	69	16	69	940	64	940

* Uncertainties represent the 95% Confidence level, based on counting statistics.
When survey data indicated less than MDA, the MDA value was used in the calculation.

By:	Date:	Project:	2278-300
Chkd:	Date:	Page #:	

Bausch & Lomb Release Survey Data

Survey Unit: **Batch Room South Wall**

Activity (dpm/100cm^2)

	Direct α			Direct β–γ		
Grid No.	Activity	Uncertainty *	MDA	Activity	Uncertainty *	MDA
A- 1	69	16	69	1366	79	1366
A- 2	69	16	69	1366	79	1366
A- 3	69	16	69	1366	79	1366
A- 4	276	33	69	1366	79	1366
A- 5	69	16	69	1366	79	1366
A- 6	164	25	69	1366	79	1366
A- 7	69	16	69	1366	79	1366
A- 8	69	16	69	1366	79	1366
A- 9	69	16	69	1366	79	1366
B- 1	69	16	69	1366	79	1366
B- 2	69	16	69	1366	79	1366
B- 3	69	16	69	1366	79	1366
B- 4	69	16	69	1366	79	1366
B- 5	69	16	69	1366	79	1366
B- 6	69	16	69	1366	79	1366
B- 7	69	16	69	1366	79	1366
B- 8	69	16	69	1366	79	1366
B- 9	69	16	69	1366	79	1366

* Uncertainties represent the 95% Confidence level, based on counting statistics.
When survey data indicated less than MDA, the MDA value was used in the calculation.

$$\mu_\alpha = x_{ave} + t_{1-\alpha,df} \frac{s_x}{\sqrt{n_s}},$$

where:

μ_α	=	value compared guideline value to determine 95% Confidence Level
x_{ave}	=	calculated mean for a survey unit,
$t_{1-\alpha,df}$	=	95% confidence level for n-1 degrees of freedom (from NUREG/CR-5849, Table B-1, "Factors for Comparison of Survey Data")
s_x	=	standard deviation of measurements in a survey unit, and
n_s	=	number of measurements within a survey unit used to determine x_{ave} and s_x.

x_{ave} = 69

$t_{1-\alpha,df}$ = 1,699

s_x = 0

n_s = 30

μ_α = 69

NOTE: When determining x_{ave}, only minimum detectable activity (MDA) values were available for some measurements locations; the MDA values were therefore used as actual activity levels for the purpose of performing this calculation.

The site specific guideline values for this project are 5000 dpm/100 cm^2 fixed plus removable and 1000 dpm/100 cm^2 removable for beta-gamma emitting nuclides, and 1000 dpm/100 cm^2 fixed plus removable and 200 for alpha emitting nuclides. If μ_α is less than the specific guideline value, the data for this survey unit satisfies the guideline at the 95% confidence level. If μ_α is greater than the specific guideline value, further remediation of the survey unit is necessary.

Individual Completing Form: D. L. Vann Date: 12-7-94

Reviewed By: R Knight Date: 1/13/95

NINETY-FIVE PERCENT CONFIDENCE CALCULATION SHEET

Survey Unit Level 1 Furnace Area Date 12-7-94

Meter Ludlum 2220 Serial # 50061

Probe 44-9 Serial # PR0 6 67 61

MDA 940 (dpm/100cm²) Survey Type Removable B-Y

Guideline Value 1000 (dpm/100cm²)

Average Measurement Level

$$x_{ave} = \frac{1}{n_s} \sum_{i=1}^{n_s} x_i$$

where:

x_{ave}	=	calculated mean for a survey unit,
n_s	=	number of measurements within a survey unit,
x_i	=	systematic and random measurements at point (i)

Σx_i 28,200 n_s 30 x_{ave} = 940

Standard Deviation

$$S_x = \sqrt{\frac{\sum_{i=1}^{n_s} (x_{ave} - x_i)^2}{n_s - 1}}$$

where:

S_x	=	standard deviation
n_s	=	number of measurements within a survey unit
x_i	=	systematic and random measurements at point (i)
x_{ave}	=	calculated mean for a survey unit

x_{ave} = 940 n_s = 30

$\Sigma (x_{ave} - x_i)^2$ = 0 s_x = 0

$$\mu_\alpha = x_{ave} + t_{1-\alpha,df} \frac{s_x}{\sqrt{n_s}},$$

where:

μ_α	=	value compared guideline value to determine 95% Confidence Level
x_{ave}	=	calculated mean for a survey unit,
$t_{1-\alpha,df}$	=	95% confidence level for n-1 degrees of freedom (from NUREG/CR-5849, Table B-1, "Factors for Comparison of Survey Data")
s_x	=	standard deviation of measurements in a survey unit, and
n_s	=	number of measurements within a survey unit used to determine $\bar{x}_{ave}$ and s_x.

x_{ave} = 940

$t_{1-\alpha,df}$ = 1.699

s_x = 0

n_s = 30

μ_α = 940

NOTE: When determining x_{ave}, only minimum detectable activity (MDA) values were available for some measurements locations; the MDA values were therefore used as actual activity levels for the purpose of performing this calculation.

The site specific guideline values for this project are 5000 dpm/100 cm^2 fixed plus removable and 1000 dpm/100 cm^2 removable for beta-gamma emitting nuclides, and 1000 dpm/100 cm^2 fixed plus removable and 200 dpm/100 cm^2 removable for alpha emitting nuclides. If μ_α is less than the specific guideline value, the data for this survey unit satisfies the guideline at the 95% confidence level. If μ_α is greater than the specific guideline value, further remediation of the survey unit is necessary.

Individual Completing Form: D. L. Vann Date: 12-7-94

Reviewed By: R. K. [illegible] Date: 1/13/95

NINETY-FIVE PERCENT CONFIDENCE CALCULATION SHEET

Survey Unit level 1 furnace Area Date 12-7-94

Meter Ludlum 2220 Serial # 50067

Probe AC-3 Serial # 712582

MDA 69 (dpm/100cm^2) Survey Type Direct α

Guideline Value 1000 (dpm/100cm^2)

Average Measurement Level

$$x_{ave} = \frac{1}{n_s} \sum_{i=1}^{n_s} x_i$$

where:

x_{ave}	=	calculated mean for a survey unit,
n_s	=	number of measurements within a survey unit,
x_i	=	systematic and random measurements at point (i)

Σx_i 2070 n_s 30 x_{ave} = 69

Standard Deviation

$$S_x = \sqrt{\frac{\sum_{i=1}^{n_s} (x_{ave} - x_i)^2}{n_s - 1}}$$

where:

S_x	=	standard deviation
n_s	=	number of measurements within a survey unit
x_i	=	systematic and random measurements at point (i)
x_{ave}	=	calculated mean for a survey unit

x_{ave} = 69 n_s = 30

$\Sigma (x_{ave} - x_i)^2$ = 0 s_x = 0

$$\mu_\alpha = x_{ave} + t_{1-\alpha,df} \frac{s_x}{\sqrt{n_s}},$$

where:

μ_α	=	value compared guideline value to determine 95% Confidence Level
x_{ave}	=	calculated mean for a survey unit,
$t_{1-\alpha,df}$	=	95% confidence level for n-1 degrees of freedom (from NUREG/CR-5849, Table B-1, "Factors for Comparison of Survey Data")
s_x	=	standard deviation of measurements in a survey unit, and
n_s	=	number of measurements within a survey unit used to determine x_{ave} and s_x.

x_{ave} = 69

$t_{1-\alpha,df}$ = 1.699

s_x = 0

n_s = 30

μ_α = 69

NOTE: When determining x_{ave}, only minimum detectable activity (MDA) values were available for some measurements locations; the MDA values were therefore used as actual activity levels for the purpose of performing this calculation.

The site specific guideline values for this project are 5000 dpm/100 cm^2 fixed plus removable and 1000 dpm/100 cm^2 removable for beta-gamma emitting nuclides, and 1000 dpm/100 cm^2 fixed plus removable and 200 dpm/100 cm^2 removable for alpha emitting nuclides. If μ_α is less than the specific guideline value, the data for this survey unit satisfies the guideline at the 95% confidence level. If μ_α is greater than the specific guideline value, further remediation of the survey unit is necessary.

Individual Completing Form: D. L. Vann Date: 12-7-94

Reviewed By: R Knight Date: 1/13/95

NINETY-FIVE PERCENT CONFIDENCE CALCULATION SHEET

Survey Unit Level 1 Furnace Area Date 12-7-94

Meter Ludlum 2220 Serial # 52836

Probe 44-9 Serial # PR0 89/8

MDA 1360 (dpm/100cm²) Survey Type Direct B-γ

Guideline Value 5000 (dpm/100cm²)

Average Measurement Level

$$x_{ave} = \frac{1}{n_s} \sum_{i=1}^{n_s} x_i$$

where:

x_{ave}	=	calculated mean for a survey unit,
n_s	=	number of measurements within a survey unit,
x_i	=	systematic and random measurements at point (i)

Σx_i 49720 n_s 30 x_{ave} = 1657.3

Standard Deviation

$$S_x = \sqrt{\frac{\sum_{i=1}^{n_s} (x_{ave} - x_i)^2}{n_s - 1}}$$

where:

S_x	=	standard deviation
n_s	=	number of measurements within a survey unit
x_i	=	systematic and random measurements at point (i)
x_{ave}	=	calculated mean for a survey unit

x_{ave} = 1657.3 n_s = 30

$\Sigma (x_{ave} - x_i)^2$ = 11,614,987 s_x = 632.9

$$\mu_\alpha = x_{ave} + t_{1-\alpha,df} \frac{s_x}{\sqrt{n_s}},$$

where:

μ_α	=	value compared guideline value to determine 95% Confidence Level
x_{ave}	=	calculated mean for a survey unit,
$t_{1-\alpha,df}$	=	95% confidence level for n-1 degrees of freedom (from NUREG/CR-5849, Table B-1, "Factors for Comparison of Survey Data")
s_x	=	standard deviation of measurements in a survey unit, and
n_s	=	number of measurements within a survey unit used to determine x_{ave} and s_x.

x_{ave} = 1657.3

$t_{1-\alpha,df}$ = 1.699

s_x = 632.9

n_s = 30

μ_α = 1853.6

NOTE: When determining x_{ave}, only minimum detectable activity (MDA) values were available for some measurements locations; the MDA values were therefore used as actual activity levels for the purpose of performing this calculation.

The site specific guideline values for this project are 5000 dpm/100 cm^2 fixed plus removable and 1000 dpm/100 cm^2 removable for beta-gamma emitting nuclides, and 1000 dpm/100 cm^2 fixed plus removable and 200 dpm/100 cm^2 removable for alpha emitting nuclides. If μ_α is less than the specific guideline value, the data for this survey unit satisfies the guideline at the 95% confidence level. If μ_α is greater than the specific guideline value, further remediation of the survey unit is necessary.

Individual Completing Form: D. L. Vann Date: 12-7-94

Reviewed By: R. Kyle Date: 1/13/95

NINETY-FIVE PERCENT CONFIDENCE CALCULATION SHEET

Survey Unit Furnace Area Date 12-7-94

Meter Bicron Serial # B218L

Probe NA Serial # NA

MDA NA (dpm/100cm^2) Survey Type Exposure

Guideline Value 10 mRem/hr ~~(dpm/100cm^2)~~

Average Measurement Level

$$x_{ave} = \frac{1}{n_s} \sum_{i=1}^{n_s} x_i$$

where:

x_{ave}	=	calculated mean for a survey unit,
n_s	=	number of measurements within a survey unit,
x_i	=	systematic and random measurements at point (i)

Σx_i 147 n_s 30 x_{ave} = 4.9

Standard Deviation

$$S_x = \sqrt{\frac{\sum_{i=1}^{n_s} (x_{ave} - x_i)^2}{n_s - 1}}$$

where:

S_x	=	standard deviation
n_s	=	number of measurements within a survey unit
x_i	=	systematic and random measurements at point (i)
x_{ave}	=	calculated mean for a survey unit

x_{ave} = 4.9 n_s = 30

$\Sigma (x_{ave} - x_i)^2$ = 2.7 s_x = 0.3

$$\mu_\alpha = x_{ave} + t_{1-\alpha,df} \frac{s_x}{\sqrt{n_s}},$$

where:

μ_α	=	value compared guideline value to determine 95% Confidence Level
x_{ave}	=	calculated mean for a survey unit,
$t_{1-\alpha,df}$	=	95% confidence level for n-1 degrees of freedom (from NUREG/CR-5849, Table B-1, "Factors for Comparison of Survey Data")
s_x	=	standard deviation of measurements in a survey unit, and
n_s	=	number of measurements within a survey unit used to determine $\bar{x}_{ave}$ and s_x.

x_{ave} = 4.9

$t_{1-\alpha,df}$ = 1.699

s_x = 0.3

n_s = 30

μ_α = 5.0

NOTE: When determining x_{ave}, only minimum detectable activity (MDA) values were available for some measurements locations; the MDA values were therefore used as actual activity levels for the purpose of performing this calculation.

The site specific guideline values for this project are 5000 dpm/100 cm^2 fixed plus removable and 1000 dpm/100 cm^2 removable for beta-gamma emitting nuclides, and 1000 dpm/100 cm^2 fixed plus removable and 200 dpm/100 cm^2 removable for alpha emitting nuclides. If μ_α is less than the specific guideline value, the data for this survey unit satisfies the guideline at the 95% confidence level. If μ_α is greater than the specific guideline value, further remediation of the survey unit is necessary.

Individual Completing Form: D. L. Vann Date: 12-7-94

Reviewed By: R Kyle Date: 1/13/95

Section 3

Affected Area Surveys

Batch Room North Wall
Batch Room South Wall
Batch Room West Wall
Batch Room East Wall
Batch Room Floor
Batch Room Overheads
Batch Room Miscellaneous Equipment
Batch Room Scale
Batch Room Hopper
Batch Room Bird Cage

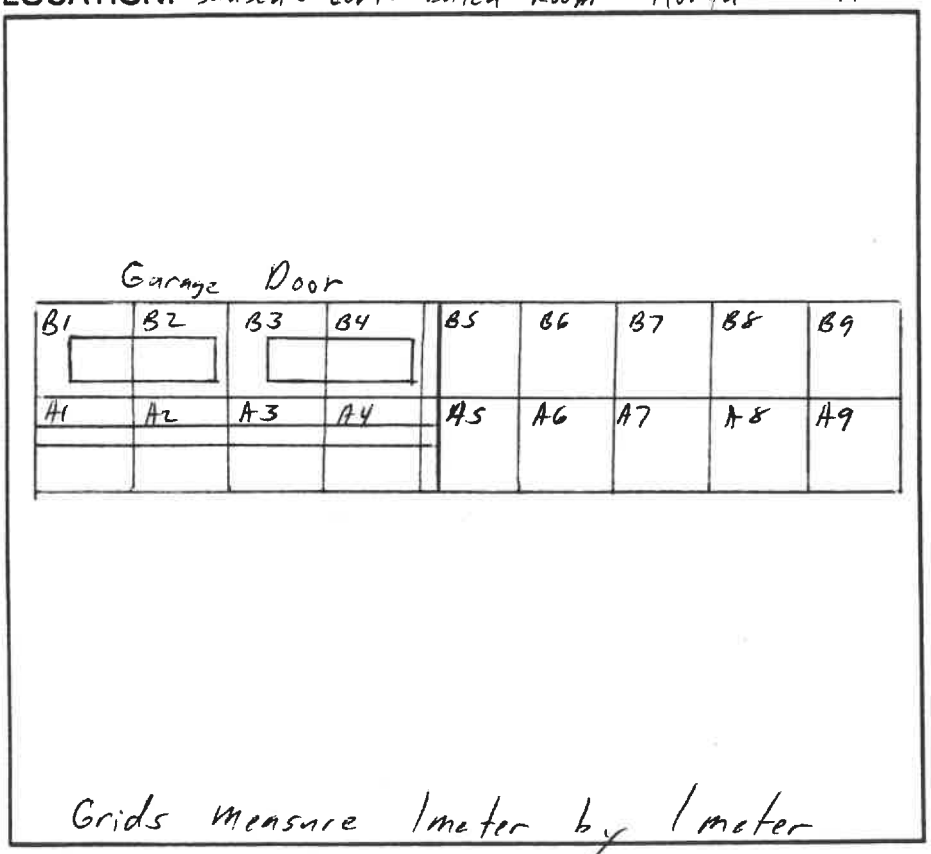
SURVEYOR D. L. Vann for Kevin Graczyk DATE 12-11-99

REVIEWER [signature] TIME 1430

SURVEY METERS

MODEL Ludlum 2220	MODEL Ludlum 2220	MODEL Bicron
SERIAL # 50061	SERIAL # 50067	SERIAL # B218L
CAL DUE 10-17-95	CAL DUE 10-17-95	CAL DUE 10-14-95
EFFICIENCY 0.238	EFFICIENCY 0.0667	EFFICIENCY NA
TYPE 44-9	TYPE AC-3	TYPE MicroRem
BKG 98 cpm	BKG 0 cpm	BKG 5 uRem/hr
MDA 1366 ~~1360~~ dpm/100cm² BLC 1-12-95	MDA 69 dpm/100cm²	MDA NA

LOCATION: Bausch & Lomb Batch Room North Wall



SMEAR #	dpm/100 cm² βγ	dpm/100 cm² α
See	Attached	

NOTE: Smear results in dpm/100 cm² unless otherwise noted. (1) denotes smear location. An * followed by a number in dpm (i.e., * 100 dpm) denotes direct probe readings in dpm/100 cm². # denotes dose rates in mR/hr.

PURPOSE: Free Release Survey

REMOVABLE CONTAMINATION

DATE: 12-11-94 LOCATION: Bansch & Lomb Room North Wall

COUNTER: Ludlum 2220 50061 βγ / Ludlum 2220 50067 α (Model / Number)

EFFICIENCY: 0.0667 (Alpha) 0.238 (Beta/Gamma)

LOCATION	DPM/100cm² βγ	DPM/100cm² α	LOCATION	DPM/100cm² βγ	DPM/100cm² α	LOCATION	DPM/100cm² βγ	DPM/100cm² α
A1	< 940	< 69						
A2	< 940	< 69						
A3	< 940	< 69						
A4	< 940	< 69						
A5	< 940	< 69						
A6	< 940	< 69						
A7	< 940	< 69						
A8	< 940	< 69						
A9	< 940	< 69						
B1	< 940	< 69						
B2	< 940	< 69						
B3	< 940	< 69						
B4	< 940	< 69						
B5	< 940	< 69						
B6	< 940	< 69						
B7	< 940	< 69						
B8	< 940	< 69						
B9	< 940	< 69						
	N							
	A							

ALPHA BKG COUNT RATE: 0 cpm

BETA/GAMMA BKG COUNT RATE: 44 cpm

α MDA (dpm/100cm²) 69

βγ MDA (dpm/100cm²) 940

SURVEYOR _____

SUPERVISOR D. L. [illegible]

AVERAGE CONTAMINATION SURVEY RESULTS

DATE: 12-11-94 LOCATION: Bausch + Lomb Batch Room North wall

INSTRUMENT: Ludlum 2220 (MODEL) 50067 (NUMBER) PROBE: AC-3 (MODEL) EFF: 0.0667

GRID NUMBER	dpm/100cm2	GRID NUMBER	dpm/100cm2
A1	< 69		
A2	< 69		
A3	< 69		
A4	< 69		
A5	< 69		
A6	< 69		
A7	< 69		
A8	< 69		
A9	< 69	N	
B1	< 69		A
B2	< 69		
B3	< 69		
B4	< 69		
B5	< 69		
B6	< 69		
B7	< 69		
B8	< 69		
B9	< 69		
N	A		

Average Background counts per minute 0

MDA (dpm/100cm 2) 69

*BASED ON AVERAGE OF 5 DIRECT MEASUREMENTS
(INITIAL DIRECT MEASUREMENT WAS GREATER THAN 60% OF GUIDELINE VALUE)

$$\frac{\text{dpm}}{100\text{cm}^2} = \frac{(\text{gross count rate}) - (\text{background count rate})}{(\text{efficiency})\ \frac{(\text{probe area})}{100\text{cm}^2}}$$

SURVEYOR D. L. Vann for Kevin Graczyk

SUPERVISOR B. Dale

AVERAGE CONTAMINATION SURVEY RESULTS

DATE: 12-11-94 LOCATION: Bausch + Lomb Batch Room North Wall

INSTRUMENT: Ludlum 2220 (650061) (MODEL / NUMBER) PROBE: 44-9 (MODEL) EFF: 0.238

GRID NUMBER	dpm/100cm2	GRID NUMBER	dpm/100cm2
A1	<1366		
A2	<1366		
A3	<1366		
A4	<1366		
A5	<1366		
A6	<1366		
A7	<1366		
A8	<1366		
A9	<1366	N	
B1	<1366	A	
B2	<1366		
B3	<1366		
B4	<1366		
B5	<1366		
B6	<1366		
B7	<1366		
B8	<1366		
B9	<1366		
N	A		

Average Background counts per minute 98 CPM

MDA (dpm/100cm 2) 1366

*BASED ON AVERAGE OF 5 DIRECT MEASUREMENTS
(INITIAL DIRECT MEASUREMENT WAS GREATER THAN 60% OF GUIDELINE VALUE)

$$\frac{\text{dpm}}{100\text{cm}^2} = \frac{(\text{gross count rate}) - (\text{background count rate})}{(\text{efficiency})\ \frac{(\text{probe area})}{100\text{cm}^2}}$$

SURVEYOR [signature]

SUPERVISOR [signature]

EXPOSURE RATE SURVEY RESULTS

DATE: 12-11-94 LOCATION: Bausch + Lomb Batch Room Northwall

INSTRUMENT: Bicron B2181 CAL DUE: 10-14-95

GRID NUMBER	EXPOSURE RATE µR/h 1cm	1m	GRID NUMBER	EXPOSURE RATE µR/h 1cm	1m
A1		5 µR/hr DLV			
A2		5 µR/hr			
A3		5 µR/hr			
A4		5 µR/hr			
A5		5 µR/hr			
A6		5 µR/hr			
A7		5 µR/hr			
A8		6 µR/hr		N/A	
A9		6 µR/hr			
B1	N/A	5 µR/hr			
B2		5 µR/hr			
B3		5 µR/hr			
B4		5 µR/hr			
B5		5 µR/hr			
B6		5 µR/hr			
B7		5 µR/hr			
B8		5 µR/hr			
B9		6 µR/hr			

MEASUREMENTS TAKEN AT 1cm AND/OR 1m ABOVE THE FLOOR.

BKG: 5 µR/hr

SURVEYOR Kim R.

SUPERVISOR

MDA CALCULATION SHEET

METER 2220 w/449 SERIAL #: 50061

TS: 1 TB: 1 RB: 98 cpm EFF: 0,238 PROBE SIZE: 15 cm²

$$MDA = \frac{2.71 + 3.29\left(\frac{98}{1} + \frac{98}{1}\right)^{1/2}}{0,238 \left(\frac{15}{100\ cm2}\right)}$$

MDA = 1366 dpm/100cm²

METER 2220 w/Ac-3 SERIAL #: 50067

TS: 1 TB: 1 RB: 0 cpm EFF: 0,0667 PROBE SIZE: 59 cm²

$$MDA = \frac{2.71 + 3.29\left(\frac{0}{1} + \frac{0}{1}\right)^{1/2}}{0,0667 \left(\frac{59}{100\ cm2}\right)}$$

MDA = 69 dpm/100cm²

METER 2220 w/44-9 SERIAL #: 50061

TS: 1 TB: 1 RB: 44 cpm EFF: 0,238 PROBE SIZE: 15 cm²

$$MDA = \frac{2.71 + 3.29\left(\frac{44}{1} + \frac{44}{1}\right)^{1/2}}{0,238 \left(\frac{15}{100\ cm2}\right)}$$

Removable only

MDA = 940 dpm/100cm².

METER _____ SERIAL #: _____

TS: _____ TB: _____ RB: _____ EFF: _____ PROBE SIZE: _____

$$MDA = \frac{2.71 + 3.29\left(\frac{\quad}{\quad} + \frac{\quad}{\quad}\right)^{1/2}}{\left(\frac{\quad}{100\ cm2}\right)}$$

MDA = _____

Technician: D. L. Vann Date: 12-11-94

Reviewed by: B Dunlap Date: 12-11-94

By:	Date:	Project:	2278-300
Chkd:	Date:	Page #:	

Bausch & Lomb Release Survey Data

Survey Unit: **Batch Room North Wall**

Activity (dpm/100cm^2)

	Removable α			Removable β–γ		
Grid No.	Activity	Uncertainty *	MDA	Activity	Uncertainty *	MDA
A- 1	69	16	69	940	64	940
A- 2	69	16	69	940	64	940
A- 3	69	16	69	940	64	940
A- 4	69	16	69	940	64	940
A- 5	69	16	69	940	64	940
A- 6	69	16	69	940	64	940
A- 7	69	16	69	940	64	940
A- 8	69	16	69	940	64	940
A- 9	69	16	69	940	64	940
B- 1	69	16	69	940	64	940
B- 2	69	16	69	940	64	940
B- 3	69	16	69	940	64	940
B- 4	69	16	69	940	64	940
B- 5	69	16	69	940	64	940
B- 6	69	16	69	940	64	940
B- 7	69	16	69	940	64	940
B- 8	69	16	69	940	64	940
B- 9	69	16	69	940	64	940

* Uncertainties represent the 95% Confidence level, based on counting statistics.
When survey data indicated less than MDA, the MDA value was used in the calculation.

By:	Date:	Project:	2278-300
Chkd:	Date:	Page #:	

Bausch & Lomb Release Survey Data

Survey Unit: **Batch Room North Wall**

Activity (dpm/100cm^2)

	Direct α			Direct β–γ		
Grid No.	Activity	Uncertainty *	MDA	Activity	Uncertainty *	MDA
A- 1	69	16	69	1366	79	1366
A- 2	69	16	69	1366	79	1366
A- 3	69	16	69	1366	79	1366
A- 4	69	16	69	1366	79	1366
A- 5	69	16	69	1366	79	1366
A- 6	69	16	69	1366	79	1366
A- 7	69	16	69	1366	79	1366
A- 8	69	16	69	1366	79	1366
A- 9	69	16	69	1366	79	1366
B- 1	69	16	69	1366	79	1366
B- 2	69	16	69	1366	79	1366
B- 3	69	16	69	1366	79	1366
B- 4	69	16	69	1366	79	1366
B- 5	69	16	69	1366	79	1366
B- 6	69	16	69	1366	79	1366
B- 7	69	16	69	1366	79	1366
B- 8	69	16	69	1366	79	1366
B- 9	69	16	69	1366	79	1366

* Uncertainties represent the 95% Confidence level, based on counting statistics.
When survey data indicated less than MDA, the MDA value was used in the calculation.

NINETY-FIVE PERCENT CONFIDENCE CALCULATION SHEET

Survey Unit Batch Room N. Wall Date 12-11-94

Meter Ludlum 2220 Serial # 50067

Probe AC-3 Serial # 712582

MDA 69 (dpm/100cm²) Survey Type ∝ removable

Guideline Value 200 (dpm/100cm²)

Average Measurement Level

$$x_{ave} = \frac{1}{n_s} \sum_{i=1}^{n_s} x_i$$

where:

x_{ave}	=	calculated mean for a survey unit,
n_s	=	number of measurements within a survey unit,
x_i	=	systematic and random measurements at point (i)

Σx_i 1242 n_s 18 x_{ave} = 69

Standard Deviation

$$S_x = \sqrt{\frac{\sum_{i=1}^{n_s} (x_{ave} - x_i)^2}{n_s - 1}}$$

where:

S_x	=	standard deviation
n_s	=	number of measurements within a survey unit
x_i	=	systematic and random measurements at point (i)
x_{ave}	=	calculated mean for a survey unit

x_{ave} = 69 n_s = 18

$\Sigma (x_{ave} - x_i)^2$ = 0 s_x = 0