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: NES, Inc./IES 44 Shelter Rock Road Danbury, CT 06810

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: NES, Inc./IES 44 Shelter Rock Road Danbury, CT 06810

| | Dwight L. Vann Radiological Engineer | 1/17/95 Date |
|------------|--|-----------------|
| | Brandon Graber | 1/17/95 Date |
| Review by: | Site Supervisor Joe Darman Project Manager | 1/17/85 Date |
| | Dennis W. Reisenweaver Department Manager | Date Date |

TABLE OF CONTENTS

| 1. | EXE | CUTIVE SUMMARY |
|----|------|--|
| 2. | WO] | RK PLAN SUMMARY 1 |
| 3. | SCH | EDULE |
| 4. | RAD | DIOLOGICAL PROTECTION |
| | 4.1 | Radiation Work Permits |
| | 4.2 | Contamination Control |
| | 4.3 | Airborne Radioactivity |
| 5. | REL | EASE CRITERIA |
| 6. | QUA | LITY ASSURANCE |
| 7. | DEC | OMMISSIONING OPERATIONS |
| | 7.1 | Mobilization |
| | 7.2 | Initial Conditions |
| | | 7.2.1 Initial surveys |
| | | 7.2.2 Initial survey results summary |
| | 7.3 | Setup Radiologically Controlled Areas (RCAs) |
| | 7.4 | Concrete Decontamination |
| | 7.5 | Other Decontamination |
| | 7.6 | Air Sampling |
| | 7.7 | Final Release Survey |
| | 7.8 | Preparation/Shipment of Waste |
| | | 7.8.1 Waste characterization |
| | 7.9 | Demobilization |
| 8. | FINA | AL RELEASE SURVEY |
| | 8.1 | Final Survey Approach |
| | | 8.1.1 Surface scan |
| | | 8.1.2 Direct measurements |
| | | 8.1.3 Removable contamination measurements |
| | | 8.1.4 Dose rate measurements |
| | 8.2 | Survey Instrumentation |
| | | 8.2.1 MDA's |
| | | 8.2.2 Interpretation of survey results |
| | 8.3 | Summary of Results |
| | | 8.3.1 Unaffected areas |
| | | |

| Table 6: Final Survey Instrumentation 1 Table 7: Summary of Results From Unaffected Area Surveys 19 Table 7a: MDA's for Unaffected Area Surveys 19 Table 7b: True Mean Activity Upper Limit at the 95% Confidence Level for the Unaffected Area Survey Units 20 Table 7c: Summary of Dose Rate Measurements for Unaffected Areas 20 Table 8: Summary of Survey Results From Affected Area (Batch Room) 2 Table 8a: MDA's for Affected Area Surveys 2 Table 8b: True Mean Activity Upper Limit at the 95% Confidence Level for the Affected Area Survey Units 22 Table 8b: True Mean Activity Upper Limit at the 95% Confidence Level for the Affected Area Survey Units 22 | | |
|---|---------------------------------------|--|
| | | |
| 9. REFERENCES | 23 | |
| ATTACHMENT 1 SURVEY SHEETS | | |
| LIST OF TABLES | | |
| Table 2: Bird Cage Table 3: South Hood Table 4: Middle Hood Table 5: Bulk Sample Results Table 6: Final Survey Instrumentation Table 7: Summary of Results From Unaffected Area Surveys Table 7a: MDA's for Unaffected Area Surveys Table 7b: True Mean Activity Upper Limit at the 95% C Area Survey Units Table 7c: Summary of Dose Rate Measurements for Unaffable 8: Summary of Survey Results From Affected Area Table 8a: MDA's for Affected Area Surveys Table 8b: True Mean Activity Upper Limit at the 95% C Area Survey Units | 10 10 10 10 10 10 10 10 | |
| LIST OF FIGURES | | |
| Figure 1: Glass Plant | | |

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

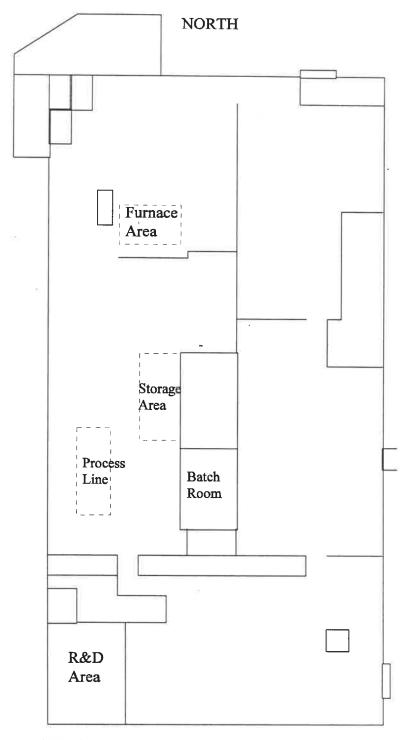
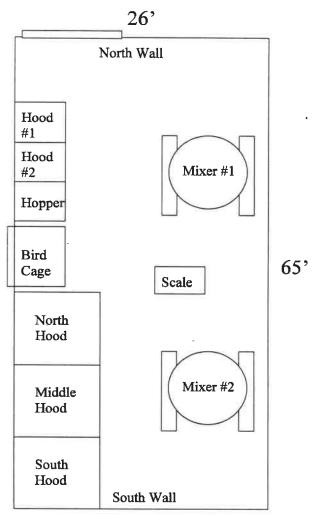


Figure 2: Batch Room



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 μ Ci/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 | $5,000 \text{ dpm } \alpha / 100 \text{ cm}^2$ | 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 |

- 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.
- 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.
- 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.
- The maximum contamination level applies to an area of not more than 100 cm².
- The amount of removable radioactive material per 100 cm² 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 μ Rem/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 μ Rem/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 KNO₃. 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 betagamma 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 betagamma 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 cm² 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 $<5 \mu$ Rem/hr above background at all surveyed locations within the building.

Bulk Samples

Bulk samples were collected from the vacuum cleaner dust and the KNO₃ 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 cm²

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 cm²

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 cm²

Table 5: Bulk Sample Results

| Sample Source | Туре | 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 KNO₃ 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 μ Ci/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 KNO₃) is as follows:

```
K-40 240 lbs x 361 pCi/g x 454 g/lb = 3.94x10^7 pCi (55 gallon drum)
Th-nat 1196 lbs x 50 pCi/g x 454 g/lb = 2.71x10^7 pCi (B-25 Box)
K-40 1196 lbs x 35 pCi/g x 454 g/lb = 1.90x10^7 pCi (B-25 Box)
```

For a total of:

27.1 μ Ci of Th-nat, and 19.0 μ Ci of K-40 in the B-25 Box (46.1 μ Ci total) 68.2 μ Ci 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 =
$$\frac{(N) (1.873e-11)}{T_{1/2}}$$
 (1)

where,

 $T_{1/2}$ = Half life (4.45x10¹⁷ seconds) N = Number of atoms per gram (2.6x10²¹ atoms per gram)

For a total of 0.11 μ Ci/g of Th-232.

With a total of 27.1 μ Ci of Th-232 in the waste container, and a specific activity of 0.11 μ Ci/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 cm² for beta/gamma emitters and 600 dpm/100 cm² 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:

$$x_m = \left[\frac{\sum x_i}{n}\right] \tag{2}$$

where,

 x_m = mean residual activity for the 1 m² 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 μ Rem/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 | surements and PRO68918 | | 0.239 | |
| Ludlum 2220 ratemeter/scaler w/44-9 probe | Beta-gamma direct measurements and scan surveys | urements and PRO6676 | | 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 | CA w/HPGe spectroscopy | | As Needed | 989997 | NA |
| Canberra 2504 | Alpha/Beta/Gamma Smear Counter | | As Needed | 11924461 | 0.342 α 0.392 βγ |
| 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):

$$MDA = \frac{\frac{2.71}{T_s} + 3.29\sqrt{\frac{R_b}{T_b} + \frac{R_b}{T_s}}}{(efficiency)(\frac{probe\ area}{100\ cm^2})},$$
(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 cm²). For MDA results see attachment 1.

8.2.2 Interpretation of survey results

Direct contamination readings were converted to dpm/100 cm² using the following formula (probe area for the Ludlum 44-9 GM pancake probe was 15 cm²):

$$dpm/100 cm^{2} = \frac{gross cpm - background cpm}{(efficiency) \left(\frac{probe area}{100 cm^{2}}\right)}$$
(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 betagamma 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 | Į. | | | | |
|--------------|------------|----------|-------|-------|------------------|
| | Direct | | Remo | vable | Dose (μRem/hour) |
| | βγ | α | βγ | 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) | | | | | | | |
|--------------|------------------------------------|------|-----------|----|--|--|--|--|
| | Dir | rect | Removable | | | | | |
| | βγ | α | βγ | 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

| | | | | | Act | ivity (| dpm/1 | 100cm ²) | | | | |
|--------------|----------------|------------------|----------------|----------------|------|----------------|-----------------|----------------------|----------------|----------------|------------------|----------------|
| Location | | Direct | | | | | Removable | | | | | |
| | | βγ α | | | | βγ | | | α | | | |
| | n _s | X _{ave} | μ_{α} | n _s | Xave | 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_{lpha} | | |
| 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)

| | | Activity (d) | pm/100cm²) | | | | |
|------------|------------|--------------|------------|------|-------------------|--|--|
| Location | Direct | | Removable | | Dose (μRem/hour) | | |
| | βγ | α | βγ | α | (7.55522) 225 627 | | |
| 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

| | Activity (dpm/100cm ²) | | | | | |
|------------|--------------------------------------|----|-----------|----|--|--|
| Location | Direct | | Removable | | | |
| | $oldsymbol{eta}_{oldsymbol{\gamma}}$ | 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

| T | | | | | Activ | ity (d | pm/10 | 0cm ²) | | | | |
|------------|----------------|------------------|----------------|----------------|-------|----------------|----------------|--------------------|----------------|----------------|------------------|----------------|
| Location | | Direct | | | | | Removable | | | | | |
| | | βγ | | | α | | βγ | | | α | | |
| | n _s | X _{ave} | μ_{α} | n _s | Xave | 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) | | | | | |
|------------|---------------------|------------------|----------------|--------------|--|--|
| | $\mathbf{n_s}$ | X _{ave} | S _x | μ_{lpha} | | |
| 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 REVIEWER D. L. Wann | DATE 12-7-94 TIME 0930 |
|--|---|
| SURVEY METERS MODEL Ladlum 2220 SERIAL # 52 836 CAL DUE 10-17-95 EFFICIENCY 0, 23 9 TYPE 44-9 BKG 98 cpm MODEL Ladlum 2220 MODEL Ladlum 2220 SERIAL # 50067 CAL DUE 10-17-95 EFFICIENCY 0,0667 TYPE 44-9 BKG 0 cpm | SERIAL # BZ/8L CAL DUE 10-14-95 EFFICIENCY NA TYPE Micro Rem BKG Suren ha |
| MDA 1360 dom/100cm2MDA 69 dom/100 cm2 LOCATION: Bausch + Lomb Bird Cage | MDA |
| HOOPER * 44958 B * 44968 B * 4498 B * 44968 B * 44 | pm) |
| rates in math. n Rem/hr @ Im PURPOSE: In tial Survey | |

| SURVEYOR | D. L. Vann | DATE | 12/7/94 |
|----------|------------|------|---------|
| REVIEWER | B. Sul | TIME | 1030 |

| SI | IB/ | /EY | M | FT | FR | 5 |
|-----|--------|--------------|------|-----|-----|---|
| זכי | \neg | <i>1</i> 🗆 1 | IVII | _ ı | _11 | · |

MODEL 1-2220

SERIAL # 52 8 3 6

SERIAL # 500 67

CAL DUE 10/17/95

EFFICIENCY 0.239

TYPE 44-9

TYPE 44-9

TYPE 4C-3

BKG 98 BKG 0 MDA 1360 dpm/100 cm² MDA 69 dpm/100 cm² MODEL Bicron

SERIAL # B218L

CAL DUE 10/14/95

EFFICIENCY NA

TYPE Micro Rem

BKG SnRem/hr

MDA NA

Bansch + Lomb LOCATION: Son +4 * 44400 *2430 X * < 1360 B * 17,600B *C69L * < 69 x *<692 (36) * 21360 B * < 69 × (41) #5 * <1360 B *<69L * <13GOB * C69 L * < 69 L * <1360B * C1360 B *1456 B * 150 X *<1360 B X <1360 B

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 mport. A Rem /hr @ /m / indirectes

PURPOSE: Initial Survey

survey performed on roof.

| SMEAR | dpm/100 cm ² | | | | |
|-----------|-------------------------|----------------|--|--|--|
| # | βγ | α | | | |
| 34 | 232 | 48 | | | |
| 35 | C32 | < 8 | | | |
| 36 | c 32 | c 8 | | | |
| 37 | c 32 | 28 | | | |
| 38 | c 3% | 28 | | | |
| 39 | C32 | < 8 | | | |
| 40 | c 32 | 28 | | | |
| 4/ | < 3 2 | - 8 | | | |
| 42 | -32 | c 8 | | | |
| Survey | 5 pm | Grmed | | | |
| on Eg | berra | 1-1-95 | | | |
| Leff. | 34,20 | % | | | |
| 18/8 eft. | 39.40 | % | | | |
| 2 Bkg | Ocpm | | | | |
| B/Y Bla | 8 cpm | | | | |
| 1 MDA | 8 dpm | 100 cm2 | | | |
| Brmpt | 32 dpm/ | 100 cm2 | | | |
| | | | | | |
| | NA | | | | |
| | | | | | |

| SURVE REVIEW | | DATE |
|-----------------|--------------|----------|
| SURVEY METERS | | |
| MODEL L-ZZZO | MODEL L-ZZZO | MQDEL |
| SERIAL # | SERIAL # | SERIAL # |

CAL DUE 10/17/95 CAL DIEFFICIENCY 0.739 EFFICIENCY TYPE TYPE BKG 98 cpm BKG

SERIAL # 50067

CAL DUE 10/17/95

EFFICIENCY 0,0667

TYPE HC-3

BKG 0 cpm

MDA 69 dpm/100cm

SERIAL #

CAL DUE

EFFICIENCY

TYPE

BKG

MDA

LOCATION: Bans, hot land Suff Hood Sifter

* < C9 &

* < 1360 B

* 1590 A

* 19,700 B

* 39, 900 B

| SMEAR | dpm/100 cm ² | | | | |
|---------|-------------------------|---------|--|--|--|
| # | βγ | α | | | |
| 3/ | 232 | 28 | | | |
| 32 | C32 | 28 | | | |
| 33 | C32 | 28 | | | |
| Surveys | pertur | ned | | | |
| on Cant | V / | | | | |
| | 34.20 | % | | | |
| Bef. | 39.40 | % | | | |
| & Bkg | O cpm | | | | |
| 8 bkg | 8 cpm | | | | |
| 2 mpt | 8 dpm/ | VOOCM2 | | | |
| B MOH | 32 dom/ | 100 cm2 | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | 1 | | | | |
| | MA | | | | |
| | | | | | |
| | | | | | |
| | | | | | |

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

2

8

2 2

S

8 نے

49

28

28

2 8

2

4

۷

ے £

3 Z

32

32

32

£ 32

C 32

c 32

C 32

<

32

32

32

32

10

11

12

13

14

15

16

17

18

19

| SURVEYOR 2. 1. Vanny for boun Grace | A DATE | 12-7- | 94 |
|---|----------|-------------|-------------------|
| REVIEWER Boule | TIME | 1/25 | |
| RVEY METERS | | | |
| | MODEL_ | BICTON | |
| SERIAL # 52 8 3 6 SERIAL # 500 67 | SERIAL# | BZ1. | 82 |
| CAL DUE 10/17/95 CAL DUE 10/17/95 | CAL DUE | 10/141 | 95 |
| EFFICIENCY 0,239 FFFICIENCY 0,0667 | EFFICIEN | ICY | YA |
| TYPE $\frac{99-9}{}$ TYPE $\frac{4c-3}{}$ | TYPE_M | | |
| BKG 98 cpm BKG cpm | BKG _S | mRem | /hr |
| MDA 1360 dem/100cm2 MDA 69 dom/100cm | MDA | NA | |
| CATION: Bansch & Lomb middle Hood | | | |
| * < 69 d * < 1360 B 2) * 1700 d * 30,100 B | SMEAR | dpm/10 | 0 cm ² |
| * < 1360 B 2 | # | βγ | α |
| 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 | 1 | < 3z | |
| W * 1360-86 B 6 6 | 2 | c 32 | 9 |
| @ * < 69 1 | 3 | C 32 | 18 |
| * 13GO # + C13GOA | 4 | < 3Z | 28 |
| | 5 | < 32 | c 8 |
| | 6 | 4 52 | < 8 |
| 21360B 4 6 60 L 21476B | 7 | < 32 | 28 |
| 2) * <1300-B | 8 | < 32 | 26 |
| | 1 a | | - 0 |

6

mears 0,117/2 1 underside F hood. of hood.

SURVEY METERS

#5

x < 681

* < 1360 B

 (\mathcal{Y})

LOCATION: Bansa

*<692 X <136013

* C69L

* < 1360 B

+4200 B +3510 X * 42,000 L 140,000 B Smear results in dpm/100 cm² unless otherwise noted. (1) denotes NOTE: 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 mp/hr. _nRem /hr @ /m

PURPOSE: Initial Survey

| SURVEYOR D.L. Vann for kevin | Graczyt | DATE | 12-7-94 | |
|------------------------------|---------|------|---------|--|
| REVIEWER | | | 1/25 | |

SURVEY METERS

MODEL Ludlum 2220

SERIAL #_ 52 83 6

CAL DUE 10/17/95

EFFICIENCY 0, 239

BKG 98 cpm

MDA 1360 Som /100cm2

MODEL Ludlym 2220

SERIAL # 50067

CAL DUE 10/17/95

EFFICIENCY 0,066

TYPE AC-3

BKG CPM

MDA 69 dom/100 cm2

MODEL Bicron

SERIAL # BZ/8L

CAL DUE 10/14/95

EFFICIENCY NA

TYPE Micro Rem

2 0 1/

MDA NA

LOCATION: Bausch + lamb middle Hood Continuenton

| | / | / |
|-----|---|---|
| | | |
| N A | | |
| | | |
| | | |
| | | |
| | | |
| V | | |

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: Intra/ Survey

| SMEAR | dpm/100 cm ² | | |
|---------|-------------------------|----------|--|
| # | βγ | α | |
| 2/ | = 32 | < s | |
| 22 | < 3Z | e 8 | |
| 23 | Z 3Z | 9 | |
| 24 | c 32 | < 8 | |
| 25 | < 3Z | 28 | |
| 26 | 5/ | 43 | |
| 27 | 232 | 35 | |
| 78 | c 32 | 29 | |
| 79 | 89 | 52 | |
| 30 | c 32 | 9 | |
| Smear - | Survey o | oun ted | |
| on G | berra | 11924461 | |
| Leff. | 34,20 | % | |
| & Bkg. | Ocem | 1-1-95 | |
| Beff. | 100 | | |
| 8 Hg | 8cpm | | |
| X MDA | 8 dpm | 100 cm2 | |
| 8 mpt | 32 den | / | |
| | Á | | |
| | N - | | |

MDA CALCULATION SHEET

| METER 2220 /44-9 SERIAL #: 52836 |
|---|
| TS: 1 TB: 1 RB: 98gm EFF: 0.239 PROBE SIZE: 15 cm 2 |
| MIDA = $\frac{2.71}{1} + 3.29(\frac{98}{1} + \frac{98}{1})$ 1/2 |
| 0.239 (15 / 100 cm2) |
| MDA = 1360 Jpm/100cm2 |
| METER 2220 "/AC-3 SERIAL #: 50067 |
| TS: 1 TB: 1 RB: Ocum EFF: 0.0667 PROBE SIZE: 59 cm2 |
| MDA = $\frac{2.71}{l} + 3.29(\frac{0}{l} + \frac{0}{l})\frac{1}{2}$ |
| 0.0667 (59 / 100 cm2) |
| MDA = 69 Jrm /100 cm 2 |
| METER CAUSERA SERIAL #: //92446/ |
| TS: 1 TB: 16 RB: Ocam EFF: 0.342 PROBE SIZE: N/A |
| MDA = $\frac{2.71}{l} + 3.29(\frac{O}{l} + \frac{O}{l})\frac{1}{2}$ |
| 0.342 (N/A / 100 cm2) |
| MDA = 8 dpm/100 cm2 |
| METER CAUBERRA SERIAL #: 11924461 |
| TS: 10 RB: 8cm EFF: 0.392 PROBE SIZE: N/A |
| MDA = $\frac{2.71}{1} + 3.29(\frac{8}{10} + \frac{8}{10})\frac{1}{2}$ |
| 0.392 (N/A / 100 cm2) |
| B MDA = 32 dpm /100 om2 |
| Reviewed by: 2. L. Land Date: 12-7-94 |
| Reviewed by: 2. L. Vann Date: 127-94 |

Section 2 Unaffected Area Surveys

R&D Area Process Line Storage Room Furnace Area

| SURVEYOR | D.L. Vern for Kevin Graczyt | DATE_ | 12/7/94 | |
|----------|-----------------------------|-------|---------|--|
| REVIEWER | | TIME | 1415 | |

SURVEY METERS

MODEL Ludlym 2220

SERIAL # SZ 836

CAL DUE_10

EFFICIENCY-

TYPE_

98 BKG _

MDA _/360 0

MODEL Ludlum 2220

CAL DUE.

BKG .

MDA _69

MODEL Bicron

CAL DUE_

EFFICIENCY

TYPE MICTO

MDA _

Bansch & Lumb RAD LOCATION: Thoods here K-40 was found Equip

Smear results in dpm/100 cm² unless otherwise noted. (1) denotes NOTE: 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 trea Release Survey

* KNO3 containing k-40 was removed from the area and brought to the batch room.

| SMEAR | | | | | |
|-------|----------|----|--|--|--|
| # | βγ | α | | | |
| See | Attach | ed | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | / | | | |
| Ť | | 7 | | | |
| | | | | | |
| | N/ | | | | |
| | /A | | | | |
| | | | | | |
| | / | | | | |
| | <u> </u> | | | | |
| / | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| / | | | | | |
| / | | | | | |

REMOVABLE CONTAMINATION

| DATE: | 12/7/0 | 74 | | LOCATION | V: Banso | chalomb | R+D | trea |
|----------|--|---------|-----------------|----------|----------|---------------|---------|-------|
| 1 | | | 50067 | EFFICIEN | CY: _0,0 | 667 | N/A | 1 |
| | Model | | Number | | Alp | ha | Beta/G | amma |
| LOCATION | DPM/1 | 157 | LOCATION | DPM/10 | | LOCATION | DPM/1 | |
| LOCATION | βγ | α | LOCATION | βγ | α | LOCATION | βγ | α / |
| 7 | | < 69 | + | | < 69 | | | -/ |
| | <u> </u> | L 69 | 22 | | c 69 | | | /_ |
| 3 | | c 69 | 23 | | c 69 | | | |
| 4 | | c 69 | 24 | | C 69 | | | |
| 5 | | c 69 | 25 | | c 69 | | | |
| G | | c 69 | 26 | NA | c 69 | | | |
| 7 | | c 69 | 27 | | c 69 | | / | |
| 8 | | c 69 | 78 | | C 69 | | | |
| 9 | | c 69 | 79 | | c°69 | | | |
| 10 | | < 69 | 30 | | C 69 | | | |
| 1/ | N/A | c 69 | | | | | N/A | |
| 12 | | c 69 | | | | | | |
| 13 | | C 69 | | | | | / | |
| 14 | | c 69 | | | | | | |
| 15 | | c 69 | | N/A | - | / | | |
| 16 | | < 69 | | | | / | | |
| 17 | | 269 | / | | | | | |
| 18 | | c 69 | | | | | | |
| 19 | | c 69 | | | | | | |
| 70 | 1 | c 69 | | | | / | | |
| | • | | | * | α MDA (| dpm/100cm 2 | 2) 6 | 9 |
| ALPHA B | α MDA (dpm/100cm ²) 69 βγ MDA (dpm/100cm ²) NA | | | | | | | |
| BETA/GAI | MMA BKG C | OUNT RA | TE: <u>////</u> | _ SURVE | YOR D.L | . Vann for | Kevin C | Smitt |
| | | | æ | SUPEF | RVISOR | Vann for B | Puler | |

REMOVABLE CONTAMINATION

| DATE: | 12-7 - | 74 | | LOCATIO | V: Bausch | + Lomb A | e + D | | |
|--|---------------------|-------------------|-------------------|-----------|---------------|------------------------|--------------|-----------|--|
| COUNTER | a. Ludly in | 2220 | 5006101 | SEFFICIEN | cv. N | A | 0,23 | 9 PLU 12- | |
| 00011121 | Model | | Soog of Number 12 | PERTOLEN | Alp | ha | Beta/G | amma | |
| | DPM/1 | 00cm ² | | DPM/10 | <u> 00cm²</u> | | <u>DPM/1</u> | | |
| LOCATION | | α | LOCATION | | α | LOCATION | βγ | α | |
| | 2 940 | I A | 7/ | 6 940 | L | | | | |
| 7 | < 940 | | 27 | c 940 | | | | | |
| 3 | c 140 | | 73 | L 940 | 1 / | | , | | |
| 4 | c 940 | | 24 | c 940 | | | | | |
| 5 | c 940 | | 25 | C 940 | λ/ | | | | |
| 6 | c 940 | | 26 | L 940 | / A | | | | |
| 7 | L 940 | | 27 | c 940 | | | / | | |
| 8 | c 940 | | 78 | C 940 | | | | 1 | |
| 9 | c 940 | | 79 | 6 940 | - | | | | |
| 10 | L 940 | N/ | 30 | < 940 | / | | N/ | | |
| 1/ | c 940 | A | | | | | / A | | |
| /2 | L 940 | | | | | | | | |
| 13 | L 940 | | | | | | | | |
| 14 | c 940 | | | | | | | | |
| 15 | c 940 | | | N | | | | | |
| 16 | L 940 | | | A | | | | | |
| 17 | c 940 | | | | | | | | |
| 18 | c 940 | | | | | | | | |
| 19 | c 940 | 3 | | | | | | | |
| 70 | c 940 | | | | | V | | | |
| | | | | | α MDA (c | lpm/100cm ² | 2) _ N// | 4 | |
| ALPHA BKG COUNT RATE: N/A βγ MDA (dpm/100cm 2) 940 | | | | | | | | | |
| BETA/GAI | MMA BKG C | OUNT RA | TE: <u>44 (</u> | Em SURVE | YOR | P. L. | Ugona | | |
| | SUPERVISOR Bunch on | | | | | | | | |

AVERAGE CONTAMINATION SURVEY RESULTS

| DATE: 17/7/94 | L(| OCATION: Bansch & C | umb RAD | | |
|--|---------------------------------------|--------------------------|-----------------------|--|--|
| INSTRUMENT: Ludlum | 2270 S# 50067 P | ROBE: HC-3 EI | F: 0,0667 | | |
| MODEL | NUMBER | MODEL | | | |
| GRID NUMBER | dpm/100cm2 | GRID NUMBER | dpm/100cm2 | | |
| 1 | < 69 69 | 70 | < 69 | | |
| Ζ | C 69 | 2/ | C 69 | | |
| 3 | C 69 | 7.2 | £ 69 | | |
| 4 | < 69 | 23 | c 69 | | |
| S | < 69 | 24 | < 69 | | |
| 6 | c 69 | 75 | · C 69 | | |
| 7 | < 69 | 76 | C 69 | | |
| 8 | C 69 | 27 | C 69 | | |
| 9 | 2 69 | 78 | C 69 | | |
| 10 | < 69 | 79 | C 69 | | |
| 11 | C 69 | 30 | C 69 | | |
| /2 | C 69 | | | | |
| /3 | c 69 | | | | |
| 14 | C 69 | | | | |
| 15 | C 69 | N | | | |
| 16 | c 69 | | A | | |
| 17 | C 69 | | | | |
| 1.8 | C 69 | | | | |
| 19 | L 69 | | | | |
| Average Background counts per minute | | | | | |
| MDA (dpm/100cm ²) *BASED ON AVERAGE OF 5 DIRECT MEASUREMENTS | | | | | |
| (INITIAL DIRECT MEASUR | REMENT WAS GREATER | THAN 60% OF GUIDELINE VA | ALUE) | | |
| | te) - (background count r | ate) SURVEYOR D. L. | Vunn for Kevin Graces | | |
| 100cm ² (efficience | y) (probe area) 100cm ² | SUPERVISOR F | Strule_ | | |

AVERAGE CONTAMINATION SURVEY RESULTS 7

| DATE: | 94 | LO | OCATION: Bansch 264 | nb ROD Area |
|---|---|-------|---------------------------|-------------|
| INSTRUMENT: Ludlum | 2220 5# 52836 | PF | ROBE: 44-9 EI | FF: _0, 239 |
| MODEL | NUMBER | | MODEL | |
| GRID NUMBER | dpm/100cm2 | | GRID NUMBER | dpm/100cm2 |
| / | < 1360 | | 76 | < 1360 |
| Z | 2800 | | 7/ | c 1360 |
| 3 | < 1360 | | 77 | c 1360 |
| У | < 1360 | | 23 | 3360 |
| 5 | c 1360 | | 24 | C 1360 |
| 6 | C 1360 | | 25 | c 1360 |
| 7 | c 1360 | | 7,6 | = 1360 |
| 8 | c 1360 | | 27 | < 1360 |
| 9 | c 1360 | :04 | 28 | C 1360 |
| 10 | L 1360 | | 79 | c 1360 |
| 11 | c 1360 | | 30 | L 1360 |
| 12 | L 1360 | | | |
| 13 | c 1360 | | | |
| 14 | L 1360 | | | |
| 15 | c 1360 | | N, | |
| 16 | c 1360 | | | A |
| 17 | C 1360 | | | |
| 18 | c 1360 | | . / | |
| 19 | 2240 | | | |
| | Averaç | je E | Background counts per min | |
| | | | MDA (dpm/100cm | 2)/360 |
| *BASED ON AVERAGE OF (INITIAL DIRECT MEASU | | | HAN 60% OF GUIDELINE V | |
| dpm(gross count ra | ate) – (background cour | nt re | ate) SURVEYOR | Gracak |
| 100cm ² (efficience | cy) <u>(probe area)</u> 100cm ² | | SUPERVISOR B | Dule |

EXPOSURE RATE SURVEY RESULTS

| DATE: 12-7-94 | LOCATION: Bruckh & Lomb RED AREA |
|--------------------------|--|
| | |
| INSTRUMENT: Biccon BaleL | ыс 1-13-95 CAL DUE: 10-14-95 10-14-95 |

| GRID NUMBER | EXPOSUF μR/h | RE RATE | GRID NUMBER | EXPOSI μR/ | SURE RATE R/h | |
|-------------|-----------------|----------|-------------|---------------|------------------|--|
| | 1cm | lm | | lcm | 1m | |
| | | 5uply | 18 | | 5wish- | |
| 2 | | suzho | 19 | | suzhr | |
| 3 | | 5 well | 26 | | 5 uzlhr | |
| 4 | | 5 uzlhr | 21 | | 547dhs | |
| 5 | | 5uz/hr | 22 | | 5uz/hr | |
| 6 | | Yur/hr | 23 | | 5uz/hr | |
| 7 | | yur/hr | 24 | NA | 5uzller | |
| 8 | | 4 w72/hr | 25 | | 5 mg/hr | |
| 9 | NA | yurlh | 26 | | 548/hr | |
| 10 | | 5uR/hr | 27 | | 5 wilh | |
| 11 | | 5 wilha | 28 | | 4 uzlhr | |
| 12 | a | 5472/hs | 29 | | ywelhr 140 | |
| 13 | | 5 with | 30 | | 4 421hc | |
| 14 | | 5uzlu | | | | |
| 15 | | Surlhr | 1. | | | |
| 16 | | SURIN | | A | | |
| 17 | | 5 well | | | | |

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

BKG: 542/hr

SURVEYOR

SUPERVISOR.

MDA CALCULATION SHEET

| METER 2220 444-9 SERIAL #: 52836 |
|--|
| TS: 1 TB: 1 RB: 98 cpm EFF: 0,239 PROBE SIZE: 15 cm2 |
| MDA = $\frac{2.71}{1} + 3.29(\frac{98}{1} + \frac{98}{1})1/2$ |
| 0,239 (15 / 100 cm2) |
| MDA = 1360 dpm /100 cm2 |
| METER 2220 4-3 SERIAL #: 50067 |
| TS: RB: Ocpm EFF: 0.0667 PROBE SIZE: S9cm2 |
| MDA = $\frac{2.71}{l} + 3.29(\frac{0}{l} + \frac{0}{l})\frac{1}{2}$ |
| 0,0667 (S9 / 100 cm2) |
| MDA = 69 dpm/100cm = |
| METER 2220 444 9 SERIAL #: 500 6/ |
| TS: / TB: / RB: 44 cpm EFF: 0.238 PROBE SIZE: 15cm2 |
| $MDA = \frac{2.71}{1} + 3.29(\frac{44}{1} + \frac{44}{1})\frac{1}{1}$ emovable |
| 0.775 (/5 / 100 cm2) |
| MDA = 940 dpm/100 cm ² |
| METER SERIAL #: |
| TS: TB: RB: EFF: PROBE SIZE: |
| $MDA = 2.71 + 3.29(+) \frac{1}{2}$ |
| (/ 100 cm2) |
| MDA = |
| Technician: D. L. Vann Date: 12/7/94 |
| Reviewed by: B Soul Date: |

| Ву: | Date: | Project: | 2278-300 |
|-------|-------|----------|----------|
| Chkd: | Date: | Page #: | 7 |

Bausch & Lomb Release Survey Data

Survey Unit:

R&D Area

Activity (dpm/100cm^2)

Removable a Removable β-γ Location Number Uncertainty * **Activity MDA Activity** Uncertainty * **MDA**

^{*} 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)

| | Direct α | | | | Direct β–γ | | | |
|----------|-----------------|---------------|------------|--|-----------------|---------------|------------|--|
| Location | | | | | | , , | | |
| Number | <u>Activity</u> | Uncertainty * | <u>MDA</u> | | <u>Activity</u> | Uncertainty * | <u>MDA</u> | |
| 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.

Bansch +Lomb

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

Meter Lndlum 2220 Serial # 50067

Probe AC-3 Serial # 7/2582

MDA 69 dom/100cm2 Survey Type Removable &

Guideline Value _____ (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; 2070

n. 30

 $x_{ave} = \underline{69}$

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, = number of measurements within a survey unit
x_i = systematic and random measurements at point (i)

 x_{ave} = calculated mean for a survey unit

 $x_{ave} = \underline{69}$ $n_s = \underline{30}$

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

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

μ_e = value compared guideline value to determine 95% Confidence Level
 x_{ave} = calculated mean for a survey unit,
 t_{1-e,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_e = mumber of measurements within a survey unit used to determine x_{ave} and s_x.

$$x_{ave} = \frac{69}{1.699}$$

$$t_{1-\alpha,df} = \frac{1.699}{0}$$

$$s_{x} = \frac{0}{0}$$

$$n_{s} = \frac{30}{0}$$

$$\mu_{\alpha} = \frac{69}{0}$$

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 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 Comp | pleting Form: | D, L | . Vann | Date: 12-7-94 |
|-----------------|---------------|----------|--------|---------------|
| Reviewed By: _ | R Kj. H | <i>!</i> | Date: | 1/10/95 |

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

Meter Ludlum ZZZO Serial # 50067

MDA 69 Apm/100cm2 Survey Type ____ Pirect &

Guideline Value / OOO (dpm/100cm²)

Average Measurement Level

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

where:

calculated mean for a survey unit,

number of measurements within a survey unit.

systematic and random measurements at point (i)

Σx, 2070

 $x_{ave} = 69$

Standard Deviation

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

where:

standard deviation

number of measurements within a survey unit

systematic and random measurements at point (i)

calculated mean for a survey unit

$$x_{ave} = \underline{G9}$$
 $n_s = \underline{30}$

$$\sum (x_{ave^-} x_i)^2 = O s_x = O$$

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

μ_s = value compared guideline value to determine 95% Confidence Level
 x_{ave} = calculated mean for a survey unit,
 t_{1-s,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 number of measurements within a survey unit used to determine x_{ave} and s_x.

$$x_{ave} = \frac{G9}{l_{1-\alpha,df}}$$

$$t_{1-\alpha,df} = \frac{l_{1}G99}{l_{1-\alpha,df}}$$

$$s_{x} = \frac{O}{3O}$$

$$\mu_{\alpha} = \frac{G9}{G9}$$

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_{π} is less than the specific guideline value, the data for this survey unit satisfies the guideline at the 95% confidence level. If μ_{π} is greater than the specific guideline value, further remediation of the survey unit is necessary.

| Individual Completing Form: | 0, | <u>L,</u> | Vann | Date: 12-7-94 |
|-----------------------------|----|-----------|-----------|---------------|
| Reviewed By: | | | _ Date: _ | 1/10/95 |

Bausch + Lomb

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

Probe ______ Serial # ______ PR 0 6 6 7 6/

MDA 940 den/100 cm2 Survey Type Removable 18-8

Guideline Value /00 6 (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_a = number of measurements within a survey unit,

= systematic and random measurements at point (i)

n_ 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, = number of measurements within a survey unit

 x_i = systematic and random measurements at point (i)

 x_{ave} = calculated mean for a survey unit

$$x_{ave} = \underline{990} \qquad n_s = \underline{30}$$

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

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

μ_x = value compared guideline value to determine 95% Confidence Level
 x_{ave} = calculated mean for a survey unit,
 t_{1-a,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 number of measurements within a survey unit used to determine x_{ave} and s_x.

$$x_{ave} = \frac{940}{1.699}$$

$$t_{1-\alpha,df} = \frac{1.699}{0}$$

$$s_x = \frac{0}{0}$$

$$n_s = \frac{30}{940}$$

$$\mu_\alpha = \frac{940}{0}$$

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 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: | 4 | Date:// | 0/95 |

Bansch + Lumb

Meter Ladlum 2270 Serial # 52 836

MDA 1360 Aprolocan Survey Type Direct B-Y

Guideline Value _____ (dpm/100cm²)

Average Measurement Level

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

where:

calculated mean for a survey unit,

number of measurements within a survey unit.

systematic and random measurements at point (i)

n. 30

 $X_{ave} = 1509$

Standard Deviation

$$S_{x} = \sqrt{\frac{\sum_{i=1}^{n_{x}} (x_{ave} - x_{i})^{2}}{n_{s} - 1}}$$

where:

standard deviation

number of measurements within a survey systematic and random measurements at point (i) calculated mean for a survey unit

 $x_{ave} = \frac{1504}{} \qquad n_s = \frac{30}{}$

 $\Sigma (x_{ave^-} x_i)^2 = \frac{C_1 225920}{5} s_x = \frac{463}{3}$

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

μ_s = value compared guideline value to determine 95% Confidence Level
 x_{ave} = calculated mean for a survey unit,
 t_{1-e,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 mumber of measurements within a survey unit used to determine x_{ve} and s_x.

$$x_{ave} = \frac{\int Soy}{\int 1.699}$$
 $t_{1-e,df} = \frac{\int 1.699}{\int 1.699}$
 $s_x = \frac{1.699}{\int 1.693}$
 $n_s = \frac{30}{\int 1.697.7}$

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 $\mu_{\rm m}$ is less than the specific guideline value, the data for this survey unit satisfies the guideline at the 95% confidence level. If $\mu_{\rm m}$ is greater than the specific guideline value, further remediation of the survey unit is necessary.

| Individual Completing Form: | <i>D.</i> | L. | Vann | Date: |
|-----------------------------|-----------|----|-------|-------|
| Reviewed By: L. K. | | | Date: | 95 |

Bansch + Lomb

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

Meter Bicron MicroRem Serial # BZ/8L

MDA NA Survey Type Exposure

Guideline Value 10 n Rem /hr (dpm/100cm²) 800 15 15 15

Average Measurement Level

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

where:

x_{vve} = calculated mean for a survey unit, n_t = number of measurements within a survey unit,

 x_i = systematic and random measurements at point (i)

Σx, 143

n. 30

 $x_{ave} = 4, 8$

Standard Deviation

$$S_{x} = \sqrt{\frac{\sum_{i=1}^{n_{x}} (x_{ave} - x_{i})^{2}}{n_{x} - 1}}$$

where:

 S_x = standard deviation

 n_i = mumber of measurements within a survey unit x_i = systematic and random measurements at point (i)

 x_{ave} = calculated mean for a survey unit

 $x_{ave} = 4.8$ $n_s = 36$

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

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

μ_e = value compared guideline value to determine 95% Confidence Level
 x_{ave} = calculated mean for a survey unit,
 t_{1-e,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_e = mumber of measurements within a survey unit used to determine x_{ave} and s_x.

$$x_{ave} = \frac{4.8}{1.699}$$

$$t_{1-\alpha,df} = \frac{1.699}{0.4}$$

$$s_x = \frac{0.4}{1.699}$$

$$r_x = \frac{30}{4.9}$$

$$r_x = \frac{4.9}{1.699}$$

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: | | Date: | 195 |

| O.L. Vann For | |
|---|--|
| SURVEYOR Keyin Graczyk | DATE _/2-7-94 |
| REVIEWER Boula | TIME |
| SURVEY METERS | |
| MODEL Ludlum 2220 MODEL Ludlym 2220 | MODEL Bicron |
| SERIAL # 52 836 SERIAL # 50067 | SERIAL # BZ/8L |
| CAL DUE 10/17/94 CAL DUE 10/17/95 | CAL DUE 10/14/95 |
| EFFICIENCY 0, 239 EFFICIENCY 0, 0667 | |
| TYPE 44-9 TYPE Ac-3 | TYPE Micro Rem |
| BKG 98 cpm BKG Ocpm | BKG SnRem/hr |
| MDA 1360 dpm/100 cm2 MDA 69 dpm/100 cm2 | MDA |
| LOCATION: Bausch & Lumb Process Line | |
| FO CO CON | SMEAR dpm/100 cm ² |
| | # βγ α |
| | See Attached |
| | |
| | |
| | / |
| | |
| Misc. Equipment (6) | |
| | |
| (29) (8) (9) | |
| | N/ |
| | / A |
| | |
| | ├ |
| (a) (b) (c) (d) | |
| T C (30) | |
| 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 Sirvey

AVERAGE CONTAMINATION SURVEY RESULTS

| DATE: 12/7/9 | 4 | 10 | CATION: Bausch + Lou | mb Process Line |
|---|------------------------------------|--------|---------------------------|-----------------|
| HDA N | ADS 20 | | | |
| MODEL | NUMBER | 1 1 | MODEL E | FF |
| GRID NUMBER | dpm/100cm2 | | GRID NUMBER | dpm/100cm2 |
| / | C 69 | T | 70 | < 69 |
| 2 | < 69 | | 7/ | C 69 |
| 3 | c 69 | | 22 | Z 69 |
| 4 | c 69 | | 23 | 269 |
| Ś | < 69 | | 24 | c 69 |
| 6 | C 69 | | 25 | c 69 |
| 7 | C 69 | | 76 | C 69 |
| 8 | · C 69 | | 27 | C 69 |
| 9 | C 69 | | 78 | C 69 |
| 10 | C 69 | | 29 | c 69 |
| // | c 69 | | 30 | c 69 |
| 12 | c 69 | | | |
| /3 | C 69 | | | |
| 14 | c 69 | | | |
| 15 | c 69 | | N | |
| 16 | c 69 | | | A |
| 17 | c 69 | | | |
| 18 | C 69 | | | |
| 19 | C 69 | | | |
| | Avera | age E | Background counts per min | 0.0 |
| *BASED ON AVERAGE OF | E DIDECT MEASURES | 45 NIZ | MDA (dpm/100cm | 2)69 |
| *BASED ON AVERAGE OF (INITIAL DIRECT MEASU | REMENT WAS GREATE | RENT | HAN 60% OF GUIDELINE V | ALUE) For |
| | te) - (background cou | ınt ra | ate) SURVEYOR | in Graczyt |
| 100cm ² (efficience | (probe area) 100cm ² | | SUPERVISOR L | Sule |

AVERAGE CONTAMINATION SURVEY RESULTS

| DATE: _/7/9 | <u>4</u> LC | DCATION: Banscholon | inh Process Line |
|--------------------------------|---|-------------------------------------|------------------|
| INSTRUMENT: Ludlum | 7770 S# 57836 pp | ROBE: 44-9 EI | F: _0,239 |
| MODEL | NOMBER | MODEL | |
| GRID NUMBER | dpm/100cm2 | GRID NUMBER | dpm/100cm2 |
| / | < 1360 | 20 | < 1360 |
| 7 | < 1360 | 7/ | c 1360 |
| 3 | c /360 | 22 | C 1360 |
| 4 | <i>e</i> 1360 | 73 | c 1360 |
| S | c 1360 | 24 | c 1360 |
| 6 | c 1360 | 25 | c 1360 |
| 7 | < 1360 | 76 | < 1360 |
| 8 | c 1360 | 27 | c 1360 |
| 9 | < 1360 | 28 | C 1360 |
| / 0 | c 1360 | 29 | C 1360 |
| 1/ | c 1360 | 30 | C 1360 |
| - /2 | < 1360 | | |
| 13 | c 1360 | | |
| 14 | c 1360 | | |
| 15 | c 1360 | N | |
| 16 | c 1360 | | A |
| 17 | c 1360 | | |
| 18 | c 1360 | | |
| 19 | 4 1360 | | |
| | Average | Background counts per min | |
| | | MDA (dpm/100cm | 2) 1360 |
| | 5 DIRECT MEASUREMEN REMENT WAS GREATER 1 | THAN 60% OF GUIDELINE V | ALUE) |
| dpm (gross count ra | ate) – (background count r | D. L rate) SURVEYOR <u>Kevir</u> | . Vunn for |
| 100cm ² (efficience | | | 0 1 |
| | 100cm ² | SUPERVISOR Z | Xu |

| | | | | | | - | e 4 07 | 17 |
|----------|--------------|--------|----------------|----------|-------------------|-----------------------------------|----------|-------------------|
| | | REM | OVABLI | E CONT | AMINA | TION | | / |
| DATE: | 12/7/94 | | | LOCATIO | N: Bans | cht Lome | h Proces | is line |
| | a: Ludlum 22 | 20 5 | #50067 | | | | NA | |
| COONTE | Model | | Number | CFFICIEN | Alp | | Beta/G | |
| | DPM/100c | | | DPM/10 | 00cm ² | | DPM/1 | 00cm ² |
| LOCATION | | α | LOCATION | βγ | α | LOCATION | βγ | α |
| / | - // | - 69 | 7/ | | C 69 | | | / |
| 2 | | 69 | 22 | | Z 69 | | | |
| 3 | 10 | 69 | 23 | | C 69 | | | |
| 4 | < | 69 | 24 | | < 69 | | | |
| 5 | 1 6 | 69 | 75 | | < 69 | | | |
| 6 | | 69 | 76 | NA | c 69 | | | |
| 7 | C | 69 | 27 | | c 69 | | / | |
| 8 | | 69 | 28 | | C 69 | | | • |
| 9 | . | 69 | 29 | | c 69 | | | |
| /0 | | 69 | 30 | | < 69 | | | |
| 1/ | 1. | 69 | | | | | N/A | |
| 12 | | - 69 | | | | | | |
| 13 | c | 69 | | | | | | |
| 14 | | 69 | | | | 1 | | |
| 15 | C | 69 | | N | | | - | |
| 16 | < | 69 | | 14 | | | | |
| 17 | | 69 | | | | | | |
| 18 | | 69 | | == | | | | |
| 19 | c | 69 | | | | | - | |
| 20 | C | 69 | | | | / | | |
| | | | | | α MDA (d | lpm/100cm ² | 69 | |
| ALPHA BK | G COUNT RAT | re: | Ocpm | _ | - | lpm/100cm ² L, Vana | | 4 |
| BETA/GAN | MMA BKG COU | NT RAT | ΓΕ: <u>///</u> | SURVE | YOR - | L. Vann evin Grac | tor | |
| | | | | | VISOR # | (a) (b) | | |

REMOVABLE CONTAMINATION

| DATE: | 12/7/94 | | | LOCATION | N: Bansc | halomb | Pricess | Line |
|----------|---------------------|--------------------|-------------------|----------------|----------|---------------|--------------|------|
| COUNTER | 7: Lnd/ym | uro s | # 50061 | EFFICIEN | CY: | A | 0,23 | 38 |
| | Model | | Number | | Alp | | Beta/Ga | amma |
| LOCATION | <u>DPM/10</u> βγ | <u>00cm</u> 2 α | LOCATION | DPM/10 | | LOCATION | <u>DPM/1</u> | i |
| 1 | | <u> </u> | 2/ | βγ | α | LOCATION | βγ | α / |
| 7 Z | c 940 | - | 22 | < 940 < 940 | -+ | | | |
| 3 | c 940 | -H | | | | | | -/- |
| | c 940 | -H | 73 | c 940 | -H | | | -/- |
| 4 | c 940 | -H | 24 | c 940 | | | | |
| .5 | c 940 | - | 25 | c 940 | N. | | | |
| G | = 940 | | 7,6 | c 940 | / A | | | / |
| 7 | c 946 | | 27 | c 940 | | | | |
| 8 | < 940 | | 78 | < 940 | | | | 130 |
| 9 | c 940 | | 79 | c 940 | - | | | |
| 10 | < 940 | N | 30 | c 940 | | | N/ | |
| 11 | c 940 | A | | | | | /A | |
| 12 | c 940 | | | | | | | |
| 13 | c 940 | | | | | | | |
| 14 | c 940 | | | | | | | |
| 15 | c 940 | | | N | | | | * |
| 16 | < 940 | | | A | | | | |
| 17 | c 940 | | | - 52 | | | | |
| 18 | < 940 | | | | | | | |
| 19 | c 940 | | | | | $\parallel /$ | | |
| 70 | c 940 | | | | | V | | |
| | | | | | α MDA (r | dpm/100cm 2 | NA | |
| ALPHA B | KG COUNT I | RATE: | N A | _ | · | dpm/100cm 2 | | > |
| BETA/GA | MMA BKG C | OUNT RA | те: <u>44 ср.</u> | | | BA | ul_ | |
| | | | | | | Ø, f, 4 | lan- | |

URIL

EXPOSURE RATE SURVEY RESULTS

| DATE: 12-7-94 | × | LO | CATION: Bausch and | Lomb Pro | icess Line |
|--------------------|-----------------|---------|--------------------|--------------|----------------|
| INSTRUMENT: Bicron | 13 2181 | CA | L DUE: 10-14-95 | | 5 |
| GRID NUMBER | EXPOSUI μR/h | RE RATE | GRID NUMBER | EXPOS! μR | URE RATE /h |
| X KRD | 1cm | 1m | | 1cm | lm |
| 1 | | 5UR/hr | 18 | | Pur /r |
| 2 | / | 5 urlbr | 19 | | GURILI |
| 3 | | 5 urihe | 20 | | GURIL |
| Ч | | suglhs | 21 | | Surlh |
| 5 | | 5URIW | 22 | | surlhr |
| 6 | | surlha | 23 | | 5ur/hr |
| 7 | | surlhr | ay | NA | 5uz/m |
| 8 | | surlha | 25 | | surpha |
| 9 | NA | 5uR/hr | 26 | | 5up/hr |
| 10 | | sur/he | 27 | | 5 uz)hr |
| 1(| | 5 URIL | 28 | | -uR/ha |

SURIL

5 ursh

surlh

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

burlhr 542/hr

BKG: 54R/hr

12

SURVEYOR

SUPERVISOR X

MDA CALCULATION SHEET

| METER ZZZO Wyyg SERIAL #: 52836 |
|--|
| TS: RB: 98cm EFF: 0,239 PROBE SIZE: 15cm 2 |
| MDA = $\frac{2.71}{1} + 329(\frac{98}{1} + \frac{78}{1})1/2$ |
| 0,239 (15/100 cm2) |
| MDA = 1360 dpm/100 cm2 |
| METER 2270 W/Ac-3 SERIAL #: 50067 |
| TS: / TB: / RB: Ocpm EFF: 0.0667 PROBE SIZE: 59 cm ² |
| MDA = $\frac{2.71}{l} + 3.29(\frac{6}{l} + \frac{6}{l})$ \(\frac{1}{2}\) |
| 0,0667 (59 / 100 cm2) |
| $MDA = \frac{69 dpm/locm^2}{}$ |
| METER 2220 1/449 SERIAL #: 500 6/ |
| TS: / TB: / RB: 44 EFF: 0,238 PROBE SIZE: /5cm 2 |
| Removable $\frac{1}{0.738(15/100 \text{ cm2})}$ |
| $Only$ $MDA = \frac{940 dpn 100 cm^2}{100 cm^2}$ |
| METER SERIAL #: |
| TS: PROBE SIZE: |
| MDA = 2.71 + 3.29(+) % |
| (/ 100 cm2) |
| MDA = |
| Technician: D. C. Vann Date: 12/7/94 |
| Reviewed by: |

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

Bausch & Lomb Release Survey Data

Survey Unit:

Process Line

Activity (dpm/100cm^2)

| | | Removable α | v | | Removable β-γ | |
|----------|-----------------|--------------------|------------|-----------------|---------------|-----|
| Location | | | | | | |
| Number | <u>Activity</u> | Uncertainty * | <u>MDA</u> | <u>Activity</u> | 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.

| Ву: | Date: | Project: 2278-300 | | | | |
|-------|-------|-------------------|--|--|--|--|
| Chkd: | Date: | Page #: | | | | |

Bausch & Lomb Release Survey Data

Survey Unit:

Process Line

Activity (dpm/100cm^2)

| | | Direct α | | | Direct β-γ | |
|----------|-----------------|-----------------|------------|----------|---------------|------------|
| Location | | | | | | |
| Number | Activity | Uncertainty * | <u>MDA</u> | Activity | Uncertainty * | <u>MDA</u> |
| 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.

MDA 1360 Survey Type Direct B-8

Average Measurement Level

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

where:

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

Σ xi 40, 800

n. 30

 $x_{eve} = 1360$

Standard Deviation

$$S_{x} = \sqrt{\frac{\sum_{i=1}^{n_{x}} (x_{ava} - x_{i})^{2}}{n_{x} - 1}}$$

where:

 S_x = standard deviation

n, = number of measurements within a survey unit x_i = systematic and random measurements at point (i)

x_{ave} = calculated mean for a survey unit

 $x_{ave} = \frac{/360}{} \qquad n_s = \frac{30}{}$

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

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

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

$$x_{ave} = \frac{/360}{1.699}$$

$$t_{1-\alpha,df} = \frac{/.699}{0}$$

$$s_x = \frac{0}{1360}$$

$$\mu_{\alpha} = \frac{/360}{1360}$$

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: 12-7-74 |
|-----------------------------|-------|---------|---------------|
| Reviewed By: | | Date:// | 10/95 |

Meter Ludlum 2270 Serial # ___ 50067 MDA 69 dpm/100cm2 Survey Type Direct & Guideline Value / OOO (dpm/100cm²)

Average Measurement Level

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

where:

calculated mean for a survey unit, number of measurements within a survey unit. systematic and random measurements at point (i)

Σx_i _ 2070

n. 30

 $x_{ave} = _{-}69$

Standard Deviation

$$S_{x} = \sqrt{\frac{\sum_{i=1}^{n_{e}} (x_{ave} - x_{i})^{2}}{n_{s} - 1}}$$

where:

standard deviation

= number of measurements within a
= systematic and random measurement
= calculated mean for a survey unit number of measurements within a survey unit systematic and random measurements at point (i)

= 69 $n_s = 30$

 $\sum (x_{ave} - x_i)^2 = \mathcal{O} s_v = \mathcal{O}$

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

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

$$x_{ave} = \frac{69}{1.699}$$

$$t_{1-\alpha,df} = \frac{1.699}{0}$$

$$s_x = \frac{0}{30}$$

$$n_s = \frac{30}{0}$$

$$\mu_\alpha = \frac{69}{0}$$

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 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: _/2-7-94 |
|-----------------------------|-------|--------------|----------------|
| Reviewed By: K | | _ Date: _/// | 0/95 |

Survey Unit <u>Process Line Date</u> <u>12-7-99</u>

Meter <u>Ludlum</u> <u>2220</u> Serial # <u>Soob 1</u>

Probe <u>44-9</u> Serial # <u>PRO 667 61</u>

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

Guideline Value <u>1000</u> (dpm/100cm²)

Average Measurement Level

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

where:

 x_{ave}
 =
 calculated mean for a survey unit,

 n_i
 =
 number of measurements within a survey unit,

 x_i
 =
 systematic and random measurements at point (i)

$$x_{ave} = 940$$

Standard Deviation

$$S_{x} = \sqrt{\frac{\sum_{i=1}^{n_{x}} (x_{ave} - x_{i})^{2}}{n_{x} - 1}}$$

where:

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

$$x_{ave} = \underline{990}$$
 $n_s = \underline{30}$

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

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

μ_a = value compared guideline value to determine 95% Confidence Level
 x_{ave} = calculated mean for a survey unit,
 t_{1-a,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 number of measurements within a survey unit used to determine x_{ave} and s_x.

$$x_{ave} = \frac{940}{l \cdot 699}$$

$$t_{1-\alpha,df} = \frac{1.699}{0}$$

$$s_{x} = \frac{0}{100}$$

$$m_{x} = \frac{30}{0}$$

$$\mu_{x} = \frac{940}{0}$$

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 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:/2-7-99 |
|-----------------------------|----|----|------------|--------------|
| Reviewed By: | | | Date: 1/10 | 195 |

Bunsch + Lond

Survey Unit process Line Date 12-7-94

Meter <u>Ludlam</u> 2220 Serial # ____ 50067

MDA 69 den/100 cm2 Survey Type Removable

Guideline Value ZOO (dpm/100cm²)

Average Measurement Level

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

where:

 X_{ave} = calculated mean for a survey unit,

n, = number of measurements within a survey unit,

 x_i = systematic and random measurements at point (i)

Σx_i 2070

n. 30

 $x_{ave} = \underline{G9}$

Standard Deviation

$$S_{x} = \sqrt{\frac{\sum_{i=1}^{n_{s}} (x_{ave} - x_{i})^{2}}{n_{s} - 1}}$$

where:

S. = 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

 $x_{ave} = \underline{69}$ $n_s = \underline{30}$

 $\Sigma (x_{ave^-} x_i)^2 = \underline{\mathcal{O}} s_x = \underline{\mathcal{O}}$

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

 μ_{\bullet} = value compared guideline value to determine 95% Confidence Level x_{ave} = calculated mean for a survey unit, $t_{1-\bullet,df}$ = 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, = mumber of measurements within a survey unit used to determine x_{rve} and s_x .

$$x_{ave} = \underline{G9}$$

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

$$s_{x} = \underline{0}$$

$$n_{s} = \underline{30}$$

$$\mu_{\alpha} = \underline{G9}$$

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.

| Individual Completing Form: | D, | L, | Vann | Date: 12-7-94 |
|-----------------------------|----|----|------|---------------|
| Reviewed By: | | | | 795 |

Survey Unit Process Line Date 12-7-94 Meter Bilron Micro Rem Serial # B 2/8 L MDA NA Survey Type Exposure Guideline Value 10 nRem/hr (dpm/100cm²)

Average Measurement Level

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

where:

calculated mean for a survey unit, number of measurements within a survey unit, systematic and random measurements at point (i)

$$\Sigma x_i = /5.5$$

$$x_{ave} = S, Z$$

Standard Deviation

$$S_{x} = \sqrt{\frac{\sum_{i=1}^{n_{s}} (x_{ave} - x_{i})^{2}}{n_{s} - 1}}$$

where:

standard deviation systematic and random measure calculated mean for a survey unit number of measurements within a survey unit systematic and random measurements at point (i).

$$x_{ave} = \frac{S, L}{s} \qquad n_s = \frac{30}{s}$$

$$\Sigma (x_{ave^-} x_i)^2 = \underline{\mathcal{Y}, \mathcal{Z}} s_x = \underline{\mathcal{O}, \mathcal{Y}}$$

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

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

$$x_{ave} = \frac{S, Z}{1.697}$$

$$t_{1-e,df} = \frac{1.697}{0.49}$$

$$s_{x} = \frac{0.4}{0.49}$$

$$n_{s} = \frac{30}{0.49}$$

$$\mu_{x} = \frac{5.3}{0.49}$$

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.

| Individual Completing Form: | <i>D.</i> | L, | Vann | Date: 12-7-94 |
|-----------------------------|-----------|----|---------|---------------|
| Reviewed By: | | | Date: _ | 1/10/95 |

| | | D. L | . Vynn for | | | (2 > | 6 / |
|---------------------|--|------------------------------------|--|------------------|-----------|--------|-------------------|
| | SURVEYO | R <u>ken</u> | a Graczyk | | DATE_ | 12-1- | - 94 |
| | REVIEWE | | Dale | | TIME _ | 1000 | |
| 0.10.757445 | | | | | | | |
| SURVEY METI | | MODEL | dlum 2220 | | MODEL | Biren | a |
| | | | | | MODEL _ | R710 | -/ |
| | 52836 | | 50067 | | SERIAL#_ | 1000 | <u></u> |
| | 10-17-95 | | 10-17-95 | | CAL DUE | 10-1 | 4-95 |
| EFFICIENC | CY_0,239 | | CY 0,0667 | | EFFICIENC | | |
| | 44-9 | | | | TYPE_M | | |
| BKG | 8 cpm | BKG | Ocpm | E | skg | | 145 |
| MDA/ | 360 dpm/100cm | ² MDA <u>6</u> | 9 dpm/100cm | 2 ² 1 | ADA | NA | |
| | Bansch & Lomb | | | | | E. | |
| | | J | | | SMEAR | dpm/10 | 0 cm ² |
| | | | | 1 | # | βγ | α |
| | | - | $\longrightarrow N$ | | See . | attach | ed |
| | | | | - | | | |
| | | Ш | | 2 | | | |
| | 6 5 | | (22) | 3) | | | |
| | | : <u>[3]</u> | (<u>(</u>) | | | | |
| (Z) | (8) | | (3) | (24) | | | |
| _ | | | | | | | |
| | (g) | (12) | 16 | | | 1 | |
| | 9 | (6) | \sim 60 | (23) | | / | |
| (3) | | (2) | | | | NI | |
| | (y) (10) | \bigcirc | (D) (19) | | | /A | |
| | | | 8 | 26 | | | |
| 30/1 | 23/1 | (28) | (27) | | | | |
| | • | | 24 | | | / | |
| | , | A 0.00 | 1 | | | | |
| | 23-30 on base | | | | | | |
| NOTE: Smear | results in dpm/100 cm location. An * followed | 2 uniess otherv bv a number i | vise noted. (1) de n dpm (i.e., * 100 | notes dpm) | | | |
| denote | s direct probe readings | in dpm/100 cr | m². # denotes do | se | | | |
| | n mR/hr. | - / | | | | | |
| PURPOSE: <u>Unz</u> | ffected area | relegse su | rvey | | / | | |
| | | | • | | | | |

REMOVABLE CONTAMINATION

| DATE: | 12-7-9 | 4 | | LOCATION | V: Banso | 4 Lomb | Storage | Room |
|----------|-----------|---------|---------------------|---|----------|-------------|---------|-------------------|
| COUNTER | 7: Ludlum | 2220 | 50067 | | | | NA | |
| | Model | | Number | | Alp | ha | Beta/G | |
| LOCATION | DPM/1 | | | . DPM/10 | | 1.004710 | DPM/1 | 00cm ² |
| LOCATION | βγ | 2 69 | LOCATION 2/ | βγ | | LOCATION | βγ | α / |
| 7 | | | 22 | | L 69 | | | -/ |
| | | C 69 | 73 | | c 69 | | | /_ |
| 3 | | c 69 | | | c 69 | | | |
| 4 | | C 69 | 24 | | c 69 | | | |
| 5 | | c 69 | 25 | N/A | C 69 | | | |
| 6 | | C 69 | 26 | | L 69 | | | / |
| 7 | | c 69 | 27 | | 69 | | / | |
| 8 | | c 69 | 28 | | L 69 | | | |
| 9 | | c 69 | 29 | | L'69 | | | |
| 10 | | c 69 | 30 | | L 69 | | | |
| 11 | N/A | L 69 | | | | | N/A | |
| 12 | | L 69 | | | | | | |
| 13 | | C 69 | · | | | | | |
| 14 | | c 69 | | | | / | | |
| 15 | | c 69 | | NA | | | | |
| 16 | | c 69 | | | | | | |
| 17 | | c 69 | | | | | | |
| 18 | | c 69 | | | | | | |
| 19 | | < 69 | | | | | | |
| 20 | - | c 69 | | | | V | | |
| | | | × | *************************************** | α MDA (| dpm/100cm 2 | 2) 69 | Y |
| ALPHA BK | G COUNT | RATE: | Ocpm | _ | By MDA (| dpm/100cm 3 | 2) /Y A | |
| BETA/GAI | MMA BKG C | OUNT RA | TE: <i>!\/ /</i> }_ | - SUBVE | O. | L. Vunn | Grazzy | 4 |
| | | | | | VISOR 7 | | le | |

REMOVABLE CONTAMINATION

| DATE: | 12-7- | 94 | | LOCATIO | N: <u>Bansc</u> | h + Lumb | Storage | Room |
|----------|------------|-------------------|-------------------|--------------|-----------------|--------------------------------|-------------|-------------------|
| COUNTER | 7: Lucllum | 2770 | 5006/ pu | EFFICIEN | CY· W/ | A | 0, 23 | - 32 |
| | Model | | Number | 3, , , , , , | Alp | ha | Beta/G | amma |
| | | 00cm ² | | DPM/10 | | | DPM/1 | 00cm ² |
| LOCATION | βγ | α | LOCATION | | α | LOCATION | βγ | α |
| 1 | 2 940 | 1 | 7/ | C940 | <u> </u> | | | |
| 7 | c 940 | 1 1 | 22 | £ 940 | / | | | |
| 3 | c 940 | | 23 | L 940 | | | - | |
| 4 | c 940 | | 24 | < 940 | | | | |
| 5 | c 940 | | 75 | C940 | א | | | |
| 6 | c 940 | | 76 | C 940 | <i> A</i> | | | |
| 7 | c 940 | | 27 | 4940 | | | | |
| 8 | c 940 | | 28 | L 940 | | F1 | | b. |
| 9 | < 740 | | 79 | 4940 | - | | | |
| /Ö | L 940 | IK | 30 | c 940 | / | | N/ | |
| 11 | L 940 | 4 | | | | | / A | |
| 12 | 6 940 | | | | | | | |
| 13 | c 940 | | | | | | | |
| 14 | c 940 | | | | 17 | | | |
| 15 | c 940 | | | N/ | | | | |
| 16 | C 940 | | | / A | | | | |
| 17 | L 940 | | | | | | | |
| 18 | 2 940 | | | | | | | |
| 19 | c 940 | | | 72 | | | | |
| 20 | < 940 | | | | | / | | |
| | | | . /. | | α MDA (d | pm/1 00 cm ² |) <u>M/</u> | 4 |
| ALPHA BK | KG COUNT | RATE: | N/A | _ | | pm/1 00cm ² | | |
| BETA/GAI | MMA BKG (| COUNT RAT | ГЕ: <u>44 с</u> р | | | D, L. | | |
| | | | | QI IDED | VISOR Z | B. 11 | 10,1 | 2 |

AVERAGE CONTAMINATION SURVEY RESULTS

| DATE: | , | LO | CATION: Bayscht Lo | und strage area |
|-------------------------------|------------------------------------|---------|---------------------------|-------------------|
| INSTRUMENT: Ladlum | ZZZO SOOG7 | PR | OBE: AC-3 E | FF: <u>0,0667</u> |
| MODEL | NOMBER | | MODEL | |
| GRID NUMBER | dpm/100cm2 | | GRID NUMBER | dpm/100cm2 |
| 1 | L 69 | | 20 | 6 6 9 |
| ζ | < 69 | | 2/ | C 69 |
| 3 | c 69 | | 22 | c 69 |
| 4 | L 69 | | 23 | L 69 |
| .5 | < 69 | | 24 | C 69 |
| Ç | C 69 | \perp | Z.S. | C 69 |
| 7. | < 69 | | 76 | c 69 |
| 8 | C 69 | | 27 | L 69 |
| 9 | L 69 | | 28 | 2 69 |
| 10 | · < 69 | | 29 | c 69 |
| 1/ | c 69 | | 30 | L 69 |
| - /]_ | Z 69 | | | |
| 13 | C 69 | | | |
| 14 | c 69 | | | |
| 15 | c 69 | | N | |
| 16 | c 69 | | | A |
| 17 | c 69 | | | |
| 18 | C 69 | | | |
| 19 | 69 | | | |
| | Avera | ige E | Background counts per mir | |
| BASED ON AVERAGE OF | 5 DIRECT MEASUREM | FNT | MDA (dpm/100cm | 2) |
| (INITIAL DIRECT MEASU | REMENT WAS GREATE | R TI | HAN 60% OF GUIDELINE V | ALUE) |
| | te) - (background cou | nt ra | ate) SURVEYOR _ Kev | in Graczylt |
| 100cm ² (efficienc | (probe area) 100cm ² | | SUPERVISOR | 3 Sol |

AVERAGE CONTAMINATION SURVEY RESULTS

DATE: 12-7-94 LOCATION: Bansch + lomb storage greg INSTRUMENT: Lud/um 2220 52836 PROBE: 44-9 EFF: 0,239
MODEL NUMBER MODEL GRID NUMBER dpm/100cm2 GRID NUMBER dpm/100cm2 C 1360 20 × 1360 2/ 2 < 1360 < 1360 3 22 c 1360 c /360 C 1360 23 c 1360 24 C 1360 L 1360 C 1366 25 2520 L 1360 26 C 1360 27 4 1360 < 1360 c 1360 28 c 1360 10 29 L 1360 C 1360 30 11 1680 C 1360 12 < 1360 13 4 1366 L 1360 N 15 c 1360 16 C 1360 17 c 1360 18 c 1360 19 < 1360 98 Average Background counts per minute ___ MDA (dpm/100cm²) /360 *BASED ON AVERAGE OF 5 DIRECT MEASUREMENTS (INITIAL DIRECT MEASUREMENT WAS GREATER THAN 60% OF GUIDELINE VALUE) (gross count rate) - (background count rate) SURVEYOR D. L. Vann for 100cm² (efficiency) (probe area) SUPERVISOR TO 100cm²

EXPOSURE RATE SURVEY RESULTS

| DATE: 12-7-94 | LOCATION: Bausch + Lomb Storage | Arca |
|---------------------------|---------------------------------|------|
| INSTRUMENT: Bicron 13218L | CAL DUE: | |

| GRID NUMBER | EXPOSUF μR/h | RE RATE | GRID NUMBER | EXPOSI μR/ | URE RATE |
|-------------|-----------------|---------|-------------|---------------|----------|
| | 1cm | lm ' | | lcm | l m |
| 1 | | surlha | 18 | | 5uzhr |
| 2 | | Suelhr | 19 | | Sughr |
| 3 | | 5 uzlhr | 20 | | 5ur/hr |
| 4 | 7 | 5 wilhr | 21 | . / | Supphr |
| 5 | 1 | surth | 22 | | suPlha |
| 6 | | Surlh | 23 | | surlha |
| 7 | | 5uzlhr | 24 | NA | Suzha |
| 8 | | suzlh | 25 | | suzlha |
| 9 | WA | Surth | 26 | | surlhr |
| 10 | | suzhr | 27 | | yuz/hr |
| | | 6uR/hr | 28 | | Yurlha |
| 12 | | 64R/hr | 29 | | 4-R/h |
| /3 | | surlha | 30 | | YUR/h |
| 14 | | Surthr | | | |
| 1.5 | | Suzlha | N. | | |
| 16 | | LUR/ hr | | А | |
| 17 | | 642/hr | | | |

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

BKG: 54R/hr

SURVEYOR

SUPERVISOR_

Burelasal

MDA CALCULATION SHEET

| METER 2270 4449 SERIAL #: 52836 |
|---|
| TS: 1 TB: 1 RB: 98 cpm EFF: 0,239 PROBE SIZE: 15cm 2 |
| MDA = $\frac{2.71}{1} + 3.29(\frac{98}{1} + \frac{98}{1})$ /2 |
| 0,239 (/5 / 100 cm2) |
| $MDA = \frac{1360 d_{pin} / 100 cm^2}$ |
| METER 2220 W/AC-3 SERIAL #: 50067 |
| TS: / RB: Ochm EFF: 0,0667 PROBE SIZE: 59 cm 2 |
| MDA = $\frac{2.71}{/} + 3.29(\frac{0}{/} + \frac{0}{/})\%$ |
| 0.0667 (59 / 100 cm2) |
| $MDA = \frac{69 dpm/100 cm^2}{}$ |
| METER 2220 444-9 SERIAL #: 506 61 |
| TS: TB: 1 RB: 44 cpm EFF: 0, 738 PROBE SIZE: 15 cm 2 |
| Removable MDA = $\frac{2.71}{1} + 3.29(\frac{44}{1} + \frac{44}{1})\frac{1}{1}$ |
| Only 0,238 (15/100 cm2) |
| $MDA = \frac{940 dpm/loocm^2}{}$ |
| METER SERIAL #: |
| TS: TB: RB: EFF: PROBE SIZE: |
| MDA = 2.71 + 3.29(+) % |
| (/ 100 cm2) |
| MDA = |
| Technician: D. L. Vann Date: 12-7-94 |
| Reviewed by: Bale: 12-7-94 |

| Ву: | Date: | Project: 2278-300 | | |
|-------|-------|-------------------|--|--|
| Chkd: | Date: | Page #: | | |

Bausch & Lomb Release Survey Data

Survey Unit:

Storage Area

Activity (dpm/100cm^2)

| | Removable α | | | Removable β–γ | | | |
|----------|-----------------|---------------|------------|-----------------|---------------|------------|--|
| Location | | | | | | | |
| Number | Activity | Uncertainty * | <u>MDA</u> | <u>Activity</u> | Uncertainty * | <u>MDA</u> | |
| 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)

| | | Direct α | | | Direct β-γ | |
|----------|-----------------|---------------|-----|----------|---------------|------|
| Location | | | | | | |
| Number | <u>Activity</u> | 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.

Survey Unit Storage Room Date __ 12-7-94 Meter Ludlum 2220 Serial # 50067 Probe $A \subset -3$ Serial # 7/2 Sez MDA 69 dpm/100cm2 Survey Type Removable & Guideline Value _______ (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 condens. systematic and random measurements at point (i)

$$x_{ave} = 69$$

Standard Deviation

$$S_{x} = \sqrt{\frac{\sum_{i=1}^{n_{x}} (x_{ave} - x_{i})^{2}}{n_{x} - 1}}$$

where:

standard deviation

number of measurements within a survey unit

systematic and random measurems calculated mean for a survey unit systematic and random measurements at point (i)

$$x_{ave} = \underline{69} \qquad n_s = \underline{30}$$

$$\sum (x_{ave^-} \cdot x_i)^2 = O s_x = O$$

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

μ_a = value compared guideline value to determine 95% Confidence Level
 x_{ave} = calculated mean for a survey unit,
 t_{1-a,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 number of measurements within a survey unit used to determine x_{ave} and s_x.

$$x_{ave} = \frac{69}{1.699}$$

$$t_{1-\alpha,df} = \frac{1.699}{0}$$

$$s_{x} = \frac{0}{30}$$

$$\mu_{\alpha} = \frac{69}{0}$$

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.

| Individual Completing Form: | D, | L, | Vann | _ Date: <u>/2-7-94</u> |
|-----------------------------|----|----|--------------|------------------------|
| Reviewed By: Reviewed By: | | | Date: _///0/ | 195 |

Survey Unit <u>Storage Room</u> Date <u>12-7-94</u>

Meter <u>Ludlam 2220</u> Serial # <u>5006/</u>

Probe <u>44-9</u> Serial # <u>PR06676/</u>

MDA <u>940 dan 100cm</u> Survey Type <u>Removable B-Y</u>

Guideline Value <u>1000</u> (dpm/100cm²)

Average Measurement Level

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

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)

$$x_{ave} = 940$$

Standard Deviation

$$S_{x} = \sqrt{\frac{\sum_{i=1}^{n_{x}} (x_{ave} - x_{i})^{2}}{n_{x} - 1}}$$

where:

S_x = standard deviation n, = mumber of measurements within a survey unit x_i = systematic and random measurements at point (i) x_{xve} = calculated mean for a survey unit

$$x_{ave} = 940$$
 $n_s = 30$
 $\sum (x_{ave} - x_i)^2 = 0$ $s_x = 0$

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

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

$$x_{ave} = 940$$

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

$$s_{x} = 0$$

$$n_{s} = 30$$

$$\mu_{\alpha} = 940$$

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.

| Individual Completing Form: | D, | L. | Vann | Date: 12-7-94 |
|-----------------------------|----|----|--------------|---------------|
| Reviewed By: | | | Date: 1/10/9 | 75 |

Survey Unit <u>Storage Area</u> Date <u>12-7-94</u>

Meter <u>Ludlum 2770</u> Serial # <u>50067</u>

Probe <u>Ac-3</u> Serial # <u>7/2 582</u>

MDA <u>G9 dpm/100cm²</u> Survey Type <u>Direct</u> &

Guideline Value <u>1000</u> (dpm/100cm²)

Average Measurement Level

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

where:

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

Σx_i 2070

n, 30

 $x_{ave} = \frac{69}{}$

Standard Deviation

$$S_{x} = \sqrt{\frac{\sum_{i=1}^{n_{x}} (x_{ave} - x_{i})^{2}}{n_{x} - 1}}$$

where:

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

$$x_{ave} = \underline{\qquad} \qquad n_s = \underline{\qquad} \qquad SO$$

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

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

μ_a = value compared guideline value to determine 95% Confidence Level
 x_{ave} = calculated mean for a survey unit,
 t_{1-a,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 number of measurements within a survey unit used to determine x_{ave} and s_x.

$$x_{ave} = \frac{69}{1.699}$$

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

$$s_{x} = \frac{0}{1.699}$$

$$n_{s} = \frac{30}{1.699}$$

$$\mu_{\alpha} = \frac{69}{1.699}$$

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.

| Individual Completing Form: | L, | Vann | Date: 12-7-94 |
|-----------------------------|----|--------|---------------|
| Reviewed By: Reviewed By: | 8 | Date:/ | 35 |

Survey Unit <u>Storage Area</u> Date <u>12-7-94</u>

Meter <u>Undlum</u> 2770 Serial # <u>52836</u>

Probe <u>44-9</u> Serial # <u>PRO 68918</u>

MDA <u>1360 dem/100cm²</u> Survey Type <u>Pirect B-8</u>

Guideline Value <u>5000</u> (dpm/100cm²)

Average Measurement Level

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

where:

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

$$x_{\text{ave}} = 1409,3$$

Standard Deviation

$$S_{x} = \sqrt{\frac{\sum_{i=1}^{n_{x}} (x_{ave} - x_{i})^{2}}{n_{x} - 1}}$$

where:

S_x = standard deviation n_i = number of measurements within a survey unit x_i = systematic and random measurements at point (i)

 x_{xve} = calculated mean for a survey unit

$$x_{ave} = \frac{/409}{3}$$
 $n_s = \frac{30}{2/7}$
 $\sum (x_{ave} - x_i)^2 = \frac{1}{374987} s_x = \frac{277}{7}$

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

 $\begin{array}{lll} \mu_{\bullet} & = & \text{value compared guideline value to determine 95\% Confidence Level} \\ x_{\text{ave}} & = & \text{calculated mean for a survey unit,} \\ t_{\text{l-e.d.ff}} & = & 95\% \text{ confidence level for n-1 degrees of freedom (from NUREG/CR-5849, Table B-1,} \\ x_{\text{s}} & = & \text{standard deviation of measurements in a survey unit, and} \\ x_{\text{l}} & = & \text{mumber of measurements within a survey unit used to determine } x_{\text{leve}} \text{ and } s_{\text{x}}. \\ \end{array}$

$$x_{ave} = \frac{/409.3}{1.6.46}$$
 $t_{1-6.46} = \frac{/.699}{217.7}$
 $s_x = \frac{217.7}{30}$
 $\mu_\alpha = \frac{/476.8}{1.476.8}$

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.

| Individual Completing Form: | <i>D.</i> | <i>L</i> , | Vann | Date:94 |
|-----------------------------|-----------|------------|---------|---------|
| Reviewed By: Reviewed By: | | | _ Date: | 1/10/95 |

Survey Unit Storage Area Date 12-7-94 Meter Bicron MicroRem Serial # BZ18L MDA NA Survey Type Expusure Guideline Value 10 nRem/hr (dpm/100cm²)

Average Measurement Level

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

where:

calculated mean for a survey unit, number of measurements within a survey unit, systematic and random measurements at point (i)

 $x_{\text{eve}} = 5$

Standard Deviation

$$S_{x} = \sqrt{\frac{\sum_{i=1}^{n_{x}} (x_{ave} - x_{i})^{2}}{n_{x} - 1}}$$

where:

standard deviation

systematic and random measurements at point (i) calculated mean for a survey unit number of measurements within a survey unit

 $x_{ave} = S$ $n_s = 30$

 $\Sigma (x_{ave^-} x_i)^2 = S = 0.5$

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

μ_s = value compared guideline value to determine 95% Confidence Level
 x_{ave} = calculated mean for a survey unit,
 t_{1-s,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 number of measurements within a survey unit used to determine x_{wa} and s_x.

$$x_{ave} = \frac{S}{t_{1-\alpha,df}}$$

$$t_{1-\alpha,df} = \frac{1.699}{0.5}$$

$$s_{x} = \frac{0.5}{30}$$

$$\mu_{\alpha} = \frac{5.2}{0.5}$$

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.

| Individual Completing Form: | <i>D</i> , | L, | Vann | Date: <u>/ Z-7-</u> 94 |
|-----------------------------|------------|----|---------|------------------------|
| Reviewed By: 1. Kg/4 | | | Date: _ | 1/13/95 |

| SURVEYOR Kevin Graczyk REVIEWER BOULT | DATE 12-7-94 TIME 1600 |
|---|---|
| SURVEY METERS MODEL Ludlum 2220 SERIAL # 52836 SERIAL # 50067 CAL DUE 10-17-95 EFFICIENCY 0.239 EFFICIENCY 0.0667 TYPE 44-9 BKG 98 cpm MDA 1360 dpm/100cm² MDA 69 dpm/100cm² LOCATION: Bansch & Land Farnace Area (level 1) W = Vertical "I" beams attached to floor. We there we have a forming platform c feet off floor. | MODEL Biron SERIAL # B 2/8L CAL DUE 10-14-95 EFFICIENCY IVA TYPE Miro Rem BKG S nRem/hr MDA NA SMEAR dpm/100 cm² # BY a See 9 Hacked |
| 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: Una flected area release Sarvey | |

REMOVABLE CONTAMINATION

| DATE: 12-7-94 | | | LOCATIO | N: Banso | 4 + Land | Furnace | Area | |
|---------------|---|------|----------|----------|-----------|------------------------|--------|-------------------|
| COUNTER | 2: Ludlym | 2220 | 500 67 | EFFICIEN | CY: | 667 | NA | |
| | Model | | Number | | Alp | | Beta/G | amma |
| LOCATION | DPM/1 | | LOCATION | DPM/10 | | | DPM/1 | 00cm ² |
| LOCATION | βγ | α | LOCATION | βγ | | LOCATION | βγ | α |
| / | | 2 69 | 2/ | / | c 69 | | | - |
| 2 | | c 69 | 27 | | L 69 | | | |
| 3 | | < 69 | 73 | | c 69 | | | |
| 4 | | L 69 | 24 | | c 69 | | | |
| 5 | | c 69 | 7.5 | N/A | c 69 | | | |
| 6 | | < 69 | 26 | | < 69 | | | |
| 7 | | < 69 | 27 | | c 69 | | | |
| 8 | | c 69 | 28 | | < 69 | | | ** |
| 9 | | = 69 | 29 | | c : 69 | | | |
| 10 | | L 69 | 30 | | c 69 | | | |
| 1/ | NA | < 69 | | | | | N/A | |
| 12 | | 269 | | - | | | | |
| /3 | | < 69 | | | | | | |
| 14 | | 4 69 | | | | | | |
| 1.5 | | c 69 | | N/A | | | | |
| 16 | | C 69 | | | | | | |
| 17 | | £ 69 | | | | | | |
| 18 | | L 69 | | | | | | |
| 19 | | C 69 | | | | | | |
| 70 | | L 69 | | | | / | | |
| | | | 1 | | α MDA (c | ipm/100cm ² | 2) 69 | 7 |
| 1 | G COUNT | | 16 | _ | βγ MDA (c | ipm/100cm ² | 2) | 1 |
| BETA/GAN | BETA/GAMMA BKG COUNT RATE: NH BETA/GAMMA BKG COUNT RATE: NH SURVEYOR Frein Graczyka | | | | | | | |
| | | | | SUPEF | IVISOR | B2 | ula | |

REMOVABLE CONTAMINATION

| DATE: | 12-7-9 | '4 | LOCATION: Bausch + Lomb Furnace Orec. 50061 52836 04 26 EFFICIENCY: N/A 0.238 Number Alpha Beta/Gamma | | | | | | |
|----------|---------------------|---------|---|----------------|-------------------|------------------------|--------|-------------------|--|
| COUNTER | R: Lupum | 2220 | 50061 5283604 | a6 EFFICIEN | CY· | ulp | . 0.23 | | |
| 000 | Model | | Number * | CHIOLEN | Alp | ha | Beta/G | | |
| | DPM/1 | | | DPM/10 |)0cm ² | | | 00cm ² | |
| LOCATION | | α | LOCATION | βγ | α | LOCATION | βγ | α | |
| i | < 940 | 1 | 21 | 4940 | | | | | |
| 2 | <940 | | 22 | 4940 | 1 | | | | |
| 3 | 4940 | | 23 | <940 | | | A. | | |
| 4 | <940 | | 24 | 4940 | | | | | |
| 5 | 4940 | | 25 | 4940 | | | | | |
| 6 | 4940 | | 26 | 4940 | | | | | |
| 7 | <940 | | 27 | < 9 40 | | | / | | |
| 8 | 4940 | 1 | 28 | Ċ940 | | | | , | |
| 9 | 4940 | NA | 29 | ۷940 | υA | | | | |
| 10 | 4940° | | 30 | ८१५० | | | | | |
| 11 | 4940 | | | | | | µ/A | | |
| 17 | 4940 | | | | | | | | |
| . 13 | 1940 | | | | | | | | |
| 14 | 4940 | | | | |) | / | | |
| 15 | 4940 | | b | A | | | | | |
| 16 | <940 | | | | | | | | |
| 17 | 4940 | | | | | | | | |
| 18 | 4940 | | | | | | | | |
| 19 | 4940 | | | | | | | | |
| 20 | 4940 | | V | | | | | | |
| | | | . 1 | | α MDA (d | dpm/100cm 2 | 2) | UlA | |
| | G COUNT I | | | | _ | dpm/100cm ² | _ | 0 | |
| BETA/GAN | MMA BKG C | OUNT RA | TE: 44 cx | SURVE | YOR | Bunal | Sul | | |
| | SUPERVISOR 2 L. Wan | | | | | | | | |

AVERAGE CONTAMINATION SURVEY RESULTS

| DATE: 12-7-94 | / | LOCATION: Bansch + Loin & Furnace trea | | | |
|---|------------------------|--|--------------|------------|--|
| INSTRUMENT: Ludlam MODEL | 7270 50067 NUMBER | | OBE: AC-3 EN | | |
| | | | | | |
| GRID NUMBER | dpm/100cm2 | | GRID NUMBER | dpm/100cm2 | |
| 1 | L 69 | | 20 | C 69 | |
| ζ | c 99 | | 7/ | < 69 | |
| 3 | 2 69 | | 22 | c 69 | |
| Ч | c 69 | | 23 | c 69 | |
| 5 | c 69 | | 24 | c 69 | |
| 6 | c 69 | | 7.5 | C 69 | |
| 7 | c 69 | | 7,6 | c 69 | |
| 8 | c 69 | | 27 | c 69. | |
| 9 | < 69 | | 7.8 | L 69 | |
| 10 | c 69 | | 29 | L 69 | |
| 1/ | C 69 | | 30 | C 69 | |
| 12 | < 69 | | | | |
| 13 | < 69 | | | | |
| 14 | c 69 | | | | |
| 15 | C 69 | | N | | |
| 16 | c 69 | T | | A | |
| 17 | c 69 | | | | |
| 18 | 2 69 | | | | |
| 19 | L 69 | | | | |
| Average Background counts per minute | | | | | |
| MDA (dpm/100cm ²)69 | | | | | |
| *BASED ON AVERAGE OF 5 DIRECT MEASUREMENTS (INITIAL DIRECT MEASUREMENT WAS GREATER THAN 60% OF GUIDELINE VALUE) D. L. Vunn for | | | | | |
| | ate) - (background cou | int ra | | | |
| 100cm ² (efficiency) (probe area) 100cm ² SUPERVISOR SUPERVISOR | | | | | |

AVERAGE CONTAMINATION SURVEY RESULTS

| | | _ | | |
|--------------------------------|------------------------------------|----------|--------------------------|------------------|
| DATE: | <u>'</u> | LO | CATION: Bansch & Lon | nb Furnace Area |
| INSTRUMENT: Ludlum MODEL | NUMBER | PR | OBE: <u>44-9</u> E | FF: 0,239 |
| GRID NUMBER | dpm/100cm2 · | | GRID NUMBER | dpm/100cm2 |
| / | < 1360 | | 70 | £ 1360 |
| Z | < 13GO | | 2/ | C 1360 |
| 3 | < 13G0 | | 22 | 2800 |
| Ч | c 1360 | | 23 | c 1360 |
| 5 | < 1360 | | 24 | c 1360 |
| G | C 1360 | | 25 | c 1360 |
| 7 | c 1360 | | 76 | c 1360 |
| 8 | c 1360 | \prod | 27 | c 1360 |
| 9 | C 1360 | \Box | 78 | 2520 |
| (0 | c 1360 | | 29 | < 1360 |
| 1/ | 3360 | П | 30 | c 1360 |
| 12 | C 1360 | | | £ 1360 |
| 13 | < 1360 | П | | 1-2-93 |
| 14 | 2240 | | | |
| 15 | 2800 | П | N | |
| 15 | 3360 | | | A |
| 17 | c 1360 | \sqcap | | |
| 18 | L 1360 | | / | |
| 19 | c 1360 | | | |
| | Avera | ge B | ackground counts per min | |
| *BASED ON AVERAGE OF | 5 DIRECT MEASUREM | IENIT | MDA (dpm/100cm | 2)/360 |
| (INITIAL DIRECT MEASU | REMENT WAS GREATE | R Th | IAN 60% OF GUIDELINE V | ALUE) . Vann for |
| 1.00 | te) - (background cou | nt ra | | _ / |
| 100cm ² (efficience | (probe area) 100cm ² | | SUPERVISOR | 3 Dula |

EXPOSURE RATE SURVEY RESULTS

INSTRUMENT: Bicron B218L CAL DUE: 10-14-95

| GRID NUMBER | EXPOSUF μR/h | RE RATE | GRID NUMBER | EXPOSU GRID NUMBER μR/ | |
|-------------|-----------------|---------|-------------|---------------------------|---------|
| | lcm | 1m | | 1cm | 1m |
| | | 5 uplho | 18 | | suphr |
| 2 | | SURIL | 19 | | 54R/hr |
| 3 | | SURIL | 20 | | suR/hr |
| 4 | | 5uR/hr | 21 | • | 5uz/h |
| 5 | | 5uR/h | 22 | | 54R/hr |
| 6 | | 5uR/hr | 23 | | 54R/hr |
| 2 | | 5uRlha | 24 | NA | 5uR/hr |
| 8 | | yur/h | 25 | | 54R/h |
| 9 | NA | yur/hr | 26 | | 5up/hr |
| 10 | | yur/hr | 27 | | 5uR/hr |
| 1/ | | 54R/m | 28 | | 5 uz/hr |
| 12 | | SuRlha | 29 | | 5UR/hr |
| /3 | | Surlha | 30 | / | 5uR/hr |
| 14 | | suz/hr | 2 | | |
| 15 | | sughr | N | | |
| 16 | | 5uR/hr | | A | |
| 17 | / | 5uR/h | | 71 | |

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

BKG: 5UR/hr

SURVEYOR

SUPERVISOR_

SURVEYOR D. L. Vann DATE 12-8-94
REVIEWER TIME 1000

SURVEY METERS

MODEL Ludlum 2220
SERIAL # SCOGI
CAL DUE 10-17-95
EFFICIENCY 0,238
TYPE 44-9
BKG 98 CPM

MODEL Biron

SERIAL # BZ/8L

CAL DUE 10-14-95

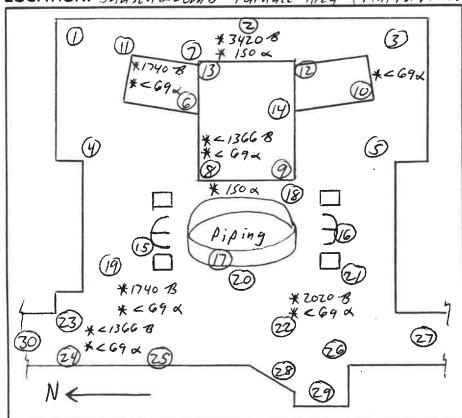
EFFICIENCY IVA

TYPE Micro Rem

BKG SnR/4r

MDA NA

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



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

| SMEAR | dpm/10 | 00 cm ² |
|-------|--------|--------------------|
| # | βγ | α |
| 1 - | < 940 | Z 69 |
| Z | 6940 | c 69 |
| 3 | c 940 | c 69 |
| 4 | L 940 | c 69 |
| 5 | c 940 | L 69 |
| 6 | c940 | c 69 |
| フ | 6940 | c 69 |
| 8 | C940 | 269 |
| 9 | c 940 | L69 |
| /0 | C940 | C69 |
| 11 | 2940 | 469 |
| 12 | C940 | C 69 |
| 13 | c940 | 69 |
| 14 | L940 | 69 |
| 15 | 6940 | 469 |
| 16 | 6940 | C 69 |
| 17 | 6940 | c 69 |
| 18 | C940 | 269 |
| 19 | 1940 | < 89 |
| 20 | 4940 | c 69 |

| | SURVEYOR REVIEWER | D.L. V | ann ul | DATE. | /2- | |
|--|----------------------|---|----------------|--|--------|-------------------|
| SURVEY METERS MODEL Sec SERIAL # CAL DUE A EFFICIENCY TYPE BKG MDA LOCATION: | S C E T T B | SERIAL # SEC PRINCY SERIAL TO SERIAL # SERIAL TO SERIAL | NA (| MODEL _ SERIAL # CAL DUE EFFICIEN TYPE BKG MØA | | 14 A |
| LOOATION. | | | | SMEAR | dpm/10 | 0 cm ² |
| | | | 1 | # | βγ | α |
| | | | 1 | 71 | L940 | < 69 |
| | | | | 22 | c940 | 169 |
| | | | | 7.3 | <940 | 169 |
| | | | | 24 | L940 | 69 |
| n n | 6 | . ~ | | 25 | c940 | 269 |
| | See P | 19e / | 1 | 26 | C940 | 669 |
| | | | 1 | 27 | 2946 | c 69 |
| | | | | 28 | 2940 | C 69 |
| | | | 1 | 79 | 2940 | 269 |
| | | | | 30 | 1940 | 469 |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | 1 | | N/ | |
| | | | d (d) dagatas | | /A | |
| smear location | . An * followed by | nless otherwise note a number in dpm (i. | e., * 100 dpm) | | | |
| denotes direct | probe readings in | dpm/100 cm ² . # de | notes dose | | | |
| rates in mR/hr. | | 0/ / - | | | | |
| PURPOSE Continu | nation of | steet 7 | | 7 | | |

MDA CALCULATION SHEET

| METER 2220 /44-9 SERIAL #: 52836 |
|--|
| TS: 1 TB: 1 RB: 98 cpm EFF: 0, 239 PROBE SIZE: 15 cm 2 |
| MDA = $\frac{2.71}{1} + 3.29(\frac{98}{1} + \frac{98}{1})\frac{1}{1}$ |
| 0. 239 (/5/100 cm2) |
| MDA = 1360 dpa/100cm ² |
| METER 2220 4/449 SERIAL #: 50061 |
| TS: / TB: / RB: 98cpm EFF: 0, 238 PROBE SIZE: 15cm2 |
| MDA = $\frac{2.71}{l} + 3.29(\frac{98}{l} + \frac{98}{l})\frac{1}{2}$ |
| 0, 238 (/S / 100 cm2) |
| $MDA = \frac{1366 dpm/100cm^2}{}$ |
| METER 2220 W/Ac -3 SERIAL #: 5006 7 |
| 1 |
| TS: TB: RB: OCPM EFF: O. 0667 PROBE SIZE: S9 cm2 |
| MDA = $\frac{2.71}{1} + 3.29(\frac{6}{1} + \frac{6}{1})$ \(\frac{1}{2}\) |
| |
| MDA = $\frac{2.71}{1} + 3.29(\frac{6}{1} + \frac{6}{1}) \%$ $\frac{6}{1} + \frac{6}{1} + \frac{6}{1$ |
| MDA = $\frac{2.71}{1} + 3.29(\frac{\circ}{1} + \frac{\circ}{1}) \%$ $\frac{0.0667}{100 \text{ cm2}}$ |
| MDA = $\frac{2.71}{1} + 3.29(\frac{6}{1} + \frac{6}{1}) \%$ $\frac{6}{1} + \frac{6}{1} + \frac{6}{1$ |
| MDA = $\frac{2.71}{1} + 3.29(\frac{\circ}{1} + \frac{\circ}{1}) \frac{1}{2}$ $0.0667 (\frac{\circ}{1} + \frac{\circ}{1}) \frac{1}{2}$ MDA = $\frac{69}{100} \frac{100}{100} \frac{1}{2}$ METER 2220 $\frac{1}{2} \frac{1}{4} \frac{1}{4} \frac{1}{4} \frac{1}{4}$ TS: $\frac{1}{100} \frac{1}{100} \frac{1}$ |
| $MDA = \frac{2.71}{1} + 3.29(\frac{0}{1} + \frac{0}{1})\%$ $0.0667 (59/100 cm2)$ $MDA = \frac{69 d_{pm}/100 cm^{2}}{1}$ $METER_{2220} \frac{1}{444} = \frac{5006}{1}$ $TS: \frac{1}{1} TB: \frac{1}{1} RB: \frac{44}{1} = \frac{5006}{1}$ $RB: \frac{44}{1} = \frac{5006}{1} = \frac{15}{1} = \frac{15}{1}$ |
| $MDA = \frac{2.71}{1} + 3.29(\frac{0}{1} + \frac{0}{1})\%$ $0.0667 (59/100 cm2)$ $MDA = \frac{69 d_{pm}/100 cm^{2}}{1}$ $METER_{2220} \frac{1}{444} = \frac{5006}{1}$ $TS: \frac{1}{1} TB: \frac{1}{1} RB: \frac{44}{1} = \frac{5006}{1}$ $RB: \frac{44}{1} = \frac{5006}{1} = \frac{15}{1} = \frac{15}{1}$ |
| MDA = $\frac{2.71}{1} + 3.29(\frac{\circ}{1} + \frac{\circ}{1}) \frac{1}{1}$ $0.0667 (\frac{\circ}{1} + \frac{\circ}{1}) \frac{1}{1}$ $0.0667 (\frac{\circ}{1} + \frac{\circ}{1}) \frac{1}{1}$ MDA = $\frac{\circ}{100} \frac{1}{100} \frac{1}{100} \frac{1}{100}$ TS: $\frac{1}{100} \frac{1}{100} \frac$ |

| Ву: | Date: | Project: 2278-300 | | |
|-------|-------|-------------------|--|--|
| Chkd: | Date: | Page #: | | |

Bausch & Lomb Release Survey Data

Survey Unit:

Furnace Area

Activity (dpm/100cm^2)

| | | Removable α | 4 | Removable β- | -γ |
|----------|-----------------|---------------|-----|---------------------------------------|------------|
| Location | | | | , , , , , , , , , , , , , , , , , , , | r |
| Number | Activity | Uncertainty * | MDA | Activity Uncertainty * | <u>MDA</u> |
| 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)

| | | Direct α | | Direct β–γ |
|----------|-----------------|-----------------|------------|----------------------------|
| Location | | | | j |
| Number | <u>Activity</u> | Uncertainty * | <u>MDA</u> | 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.

level

Survey Unit furnace freq Date 12-7-94

Meter Ludlum 2270 Serial # 50067

MDA 69 dem/100 cm2 Survey Type Removable &

Guideline Value _____ (dpm/100cm²)

Average Measurement Level

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

where:

x_{ave} = calculated mean for a survey unit, n, = number of measurements within a survey unit,

 x_i = systematic and random measurements at point (i)

Σ x4 2070

n, 30

 $x_{ave} = 69$

Standard Deviation

$$S_{x} = \sqrt{\frac{\sum_{i=1}^{n_{d}} (x_{eve} - x_{i})^{2}}{n_{s} - 1}}$$

where:

 S_x = standard deviation

n_i = number of measurements within a survey unit x_i = systematic and random measurements at point (i)

 x_{ave} = calculated mean for a survey unit

 $x_{ave} = \frac{qq}{}$ $n_s = 30$

 $\Sigma (x_{ave} - x_i)^2 = \underline{\hspace{1cm}} \circ s_x = \underline{\hspace{1cm}} \circ$

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

 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_e and s

$$x_{ave} = 69$$

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

$$s_x = \mathcal{O}$$

$$n_s = l8$$

$$\mu_{\alpha} = 69$$

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.

| Individual Completing Form: | Date: <u>1-10-95</u> |
|-----------------------------|----------------------|
| Reviewed By: | Date: _//13/95 |

Survey Unit Batch Room N. Wall Date 12-11-94 Meter Ludbum 2220 Serial # 50061 Probe 44-9 Serial # ______ Serial # ______ PRo 66761 MDA 940 (dpm/100cm²) Survey Type removable B-8 Guideline Value /boo (dpm/100cm²)

Average Measurement Level

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

where:

calculated mean for a survey unit, number of measurements within a survey unit, systematic and random measurements at point (i)

Σx; 16920

 $X_{ave} = 940$

Standard Deviation

$$S_{x} = \sqrt{\frac{\sum_{i=1}^{n_{s}} (x_{ave} - x_{i})^{2}}{n_{s} - 1}}$$

where:

standard deviation number of measurements within a survey unit systematic and random measurements at point (i) calculated mean for a survey unit

$$x_{ave} = 940 \qquad n_s = 18$$

$$\sum (x_{ave} - x_i)^2 = 0 \qquad s_s = 0$$

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

 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

 $n_s = n_s$ number of measurements within a survey unit used to determine x_s and s.

$$X_{ave} = 940$$

$$t_{1-\alpha,df} = /.740$$

$$s_x = O$$

$$n_s = 18$$

$$\mu_{\alpha} = 940$$

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.

| Individual Completing Form: | Date: 1-16-95 |
|-----------------------------|---------------|
| Reviewed By: L. Kold | Date: 1/13/95 |

Average Measurement Level

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

where:

 $egin{array}{lll} x_{ave} & = & & \mbox{calculated mean for a survey unit,} \\ n_s & = & & \mbox{number of measurements within a survey unit,} \\ x_i & = & & \mbox{systematic and random measurements at point (i)} \\ \end{array}$

 $\Sigma x_i /242$

n<u>, /8 </u>

 $x_{ave} = \underline{69}$

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

 $x_{ave} = \underline{69}$ $n_s = \underline{18}$

 $\Sigma (x_{ave^-} x_i)^2 = \underline{\bigcirc} \qquad s_x = \underline{\bigcirc}$

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

 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 number of measurements within a survey unit used to determine x_e and x_e .

$$x_{ave} = \underline{69}$$

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

$$s_x = \underline{0}$$

$$n_s = \underline{18}$$

$$\mu_{\alpha} = \underline{69}$$

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.

| Individual Completing Form: J. Alu- | Date: 1/10/85 |
|-------------------------------------|----------------|
| Reviewed By: L. Kay | Date: _//13/95 |

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

Meter <u>Ludlum 2220</u> Serial # <u>Soo 66</u>

Probe <u>44-9</u> Serial # <u>PRo 6676/</u>

MDA <u>1366</u> (dpm/100cm²) Survey Type <u>direct 3-7</u>

Guideline Value <u>Sooo</u> (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)

Σ x_i 24588

n_s__18___

 $x_{ave} = /366$

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

 $x_{ave} = 1366$ $n_s = 18$

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

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

 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_{re} and s.

$$x_{ave} = \sqrt{366}$$

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

$$s_x = 0$$

$$n_s = \frac{8}{100}$$

$$\mu_{\alpha} = 1366$$

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.

| Individual Completing Form: J. Alba | Date: 1/10/25 |
|-------------------------------------|---------------|
| Reviewed By: Reviewed By: | Date: _//3/95 |

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

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)

 $\sum x_i = \frac{93}{18} \qquad x_{ave} = \frac{5.2}{1}$

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

 $x_{ave} = S.Z$ $n_s = /8$

 $\Sigma (x_{ave} - x_i)^2 = \underline{7.5} \qquad s_x = \underline{0.9}$

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

 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 s_x number of measurements within a survey unit used to determine s_x and s_x .

$$x_{ave} = \frac{S, Z}{1,740}$$

$$t_{1-\alpha,df} = \frac{1,740}{0}$$

$$s_x = \frac{0,4}{18}$$

$$n_s = \frac{18}{18}$$

$$\mu_\alpha = \frac{S.3}{18}$$

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.

| Individual Completing Form: | 0, 4, | Vann | Date: |
|-----------------------------|-------|-------------|-------|
| Reviewed By: | | Date://13/4 | 95 |

| SURVEYOR Kevin Grade REVIEWER | For DATE 12-11-94 TIME 1530 |
|---|---|
| CAL DUE 10-17-95 CAL DUE 10-11 EFFICIENCY 0, 238 EFFICIENCY 0, 2 | SERIAL # B2/8 L 7-95 CAL DUE 10-14-95 EFFICIENCY IVA TYPE MicroRem |
| BKG 98 cpm BKG 0 cpm MDA 1366 dpm/leocm2MDA 69 dpm | MDA Surem/hr NA |
| B1 82 83 84 85 86 87 88 A1 A2 A3 A4 A5 A6 A7 A8 | SMEAR dpm/100 cm ² # By a A9 |
| NOTE: Smear results in dpm/100 cm² unless otherwise noted smear location. An * followed by a number in dpm (i.e denotes direct probe readings in dpm/100 cm². # denotes in mR/hr. PURPOSE: Free Re/case Survey | ., - 100 apm) |

REMOVABLE CONTAMINATION

| DATE: | 12-11-0 | 74 | 50061 | LOCATIO | V:Ban. | sch thome | 5 Batch | Room |
|------------|--|-------------------|----------|----------------|-------------------|---------------------------------|---------|-------------------|
| COUNTER | 3. Ludlum | 2220 | 50067 | EFFICIEN | 50 A CV: 01 G | th mall | 0,7.3 | . 5 |
| 0001112 | Model | | Number | Z. I TOTEN | Alp | | Beta/G | |
| | DPM/1 | 00cm ² | | DPM/10 | 00cm ² | | DPM/1 | 00cm ² |
| LOCATION | βγ | α | LOCATION | βγ | α | LOCATION | | α |
| A1 | c 940 | c 69 | | | | | | |
| ΑZ | c 940 | < 69 | | | | | | |
| A3 | C 940 | c 69 | | | | | | |
| A4 | c 940 | c 69 | | | | | | |
| #5 | c 940 | C 69 | | | | | | |
| 46 | C 940 | 2 69 | | | / | | | |
| A7 | C 940 | c 69 | | | | | / | |
| A8 | < 940 | C 69 | | | | | | 8 |
| A9 | C 740 | c 69 | | | • | | | |
| 81 | L 940 | C 69 | | $\mathcal{N}/$ | | | N/. | |
| 82 | c 940 | C 69 | | / A | | | / A | |
| B3 | c 940 | C 69 | | | | | | |
| BY | c 940 | .c 69 | | | | | | |
| BS | c 940 | c 69 | | | | | | |
| B6 | C 940 | c 69 | | | | | | |
| <i>B</i> 7 | C 940 | C 69 | | | | | | |
| B8 | C 940 | 269 | | | | | | |
| B9 | c 940 | 269 | | | | | | |
| | 1 | | | | | | | |
| | A | | | | | | | |
| | | · · · · · · · · · | 7 | | α MDA (c | ipm/100cm ² | 69 | |
| ALPHA BK | G COUNT I | RATE: | ocpm | - | | lpm/1 0 0cm ² | ~ | |
| BETA/GAI | BETA/GAMMA BKG COUNT RATE: 44 cm SURVEYOR D. L. Vann | | | | | | | |
| | | | | | VISOR C | | 2 l | |

AVERAGE CONTAMINATION SURVEY RESULTS

| DATE: /2-//- | 94 | LOCATION: Brusch + Lumb Batch Room South Ling | | |
|---|---|---|--|--|
| INSTRUMENT: Ludlum MODEL | 2220 SOOG7 NUMBER | PROBE: AC-3 EFF: 0.0667 MODEL | | |
| GRID NUMBER | dpm/100cm2 . | GRID NUMBER dpm/100cm2 | | |
| Á/ | C 69 | | | |
| Ar | C 69 | | | |
| <i>‡</i> 3 | 2 69 | | | |
| A 4 | * 276 | | | |
| A-S | 269 | | | |
| A-6 | * 164 | | | |
| A7 | 69 | | | |
| A8 | 269 | | | |
| 49 | 69 | | | |
| B / | L 69 | | | |
| BZ | L 69 | . / | | |
| 83 | L 69 | | | |
| 34 | < 6g | | | |
| B 5 | C 69 | | | |
| B 6 | L 69 | | | |
| <i>B</i> 7 | c 69 | | | |
| 38 | 69 | | | |
| B9 | C 69 | | | |
| N | A | | | |
| | Averag | ge Background counts per minute | | |
| *BASED ON AVERAGE OF 5 DIRECT MEASUREMENTS (INITIAL DIRECT MEASUREMENT WAS GREATER THAN 60% OF GUIDELINE VALUE) D. L. Vann For | | | | |
| $\frac{\text{dpm}}{100\text{cm}^2} = \frac{\text{(gross count rate)}}{\text{(efficiency)}}$ | ate) – (background cour | nt rate) SURVEYOR kevin Graczyla | | |
| (emciend | cy) <u>(probe area)</u> 100cm ² | SUPERVISOR Dule | | |

AVERAGE CONTAMINATION SURVEY RESULTS

| INSTRUMENT: Ludlum 2200 50001 MODEL NUMBER | | | CATION: Bauch & Lomb | o Batch Roma South Wall | |
|---|---|--|-------------------------|----------------------------|--|
| MODEL | NUMBER | FIL | OBE: 44-9 E | FF: | |
| GRID NUMBER | dpm/100cm2 | | GRID NUMBER | dpm/100cm2 | |
| AI | 41366 | | | | |
| A2 | 41366 | | | | |
| A3 | 41366 | | | - | |
| AY | * 41366 | | | | |
| A5 | * 41366 | Ш | | | |
| AG | * 413CC | | | | |
| A7 | < 1366 | Ш | | | |
| A8 | * 41346 | Щ | | | |
| A9 | 41366 | Ш | A | XA | |
| BI | 41366 | $\perp \downarrow \downarrow$ | | | |
| BQ | < 1366 | Щ | | | |
| B3 | 41366 | Щ | | | |
| BY | 41366 | | | | |
| B5 | 41366 | $\perp \! \! \! \! \! \! \! \! \! \! \! \! \! \! \! \! \! \! \!$ | | | |
| BG | 41366 | $\perp \downarrow \downarrow$ | | | |
| <u> </u> | 4 1366 | \dashv | | | |
| <u>B</u> 8 | 41366 | \dashv | -/ | - | |
| | < 1366 | \dashv | | | |
| | A | | | | |
| | Avera | ige B | ackground counts per mi | | |
| *BASED ON AVERAGE OF 5 DIRECT MEASUREMENTS (INITIAL DIRECT MEASUREMENT WAS GREATER THAN 60% OF GUIDELINE VALUE) | | | | | |
| | ate) - (background cou | int ra | te) SURVEYOR | ROLL | |
| 100cm ² (efficience | cy) <u>(probe area)</u> 100cm ² | | SUPERVISOR & | Sundon Let | |

EXPOSURE RATE SURVEY RESULTS

| DATE: 12-11-94 | | LOCATION | V: Bausch & Lomb | Botch Room | South |
|--------------------|-----------------------|------------|------------------|---------------|---------------|
| INSTRUMENT: Bicron | 3218L | | 10-14-95 | | Wall |
| | | | | | |
| GRID NUMBER | EXPOSURE RATE μR/h | | GRID NUMBER | EXPOSU μR/ | JRE RATE h |
| Aı | 1cm 9 lm/h | | | 1cm | 1m |
| A2 | 7 URIL | | | | |
| A3 | 7 4R11 | v | | | |
| AY | 7u2/ | nc | | | _/ |
| A5 | 7u2 | he | | | |
| A6 | 84721) | | | | |
| A7 | 7upl | hr hr | | | = |
| A8 | 6 uzl | 20 | | | |
| A9 | NA Luzh | v | N | | |
| BI | 6uz1 | مح | | A | |
| B2 | (cup) | \r | | | |
| B3 | (Jug) | hr | | | |
| BY | 7484 | _ | | | |
| B5 | 7 mg) | | | | |
| B6 | 745 | W | | | |
| 37 | (res) | <u>v</u> / | | | |
| B8 | Luz! | <u> </u> | | | |
| <u>B9</u> | (Juz) | AT | | | |
| | | | | | |
| MEASUREMENTS TAKE | N AT 1cm AND/OR 1m | ABOVE TH | E FLOOR. | | |

BKG: 747/hr

MDA CALCULATION SHEET

| METER 2220 /449 SERIAL #: 5006/ |
|---|
| TS: 1 TB: 1 RB: 98cpm EFF: 0, 238 PROBE SIZE: 15cm 2 |
| MIDA = $\frac{2.71}{l} + 3.29(\frac{98}{l} + \frac{98}{l})\frac{1}{2}$ |
| 0,238 (15/100 cm2) |
| MDA = 1366 dpm/100 cm2 |
| METERZZZO W/Ac-3 SERIAL #: 50067 |
| TS: 1 TB: 1 RB: Ocam EFF: 0.0667 PROBE SIZE: 59cm2 |
| MDA = $\frac{2.71}{1} + 3.29(\frac{0}{1} + \frac{0}{1})$ \(\frac{1}{2}\) |
| 0,0667 (S9 / 100 cm2) |
| MDA = 69 dpm/100cm2 |
| METER ZZZO MYY-SERIAL N: SOOC |
| |
| TS: TB: RB: 44 cpm EFF: 0, 238 PROBE SIZE: / 5cm 2 |
| Removable MDA = $\frac{2.71}{1} + 3.29(\frac{44}{1} + \frac{44}{1})^{1/2}$ |
| Removable $0 = \frac{2.71}{1} + 3.29(\frac{44}{1} + \frac{44}{1})^{1/2}$ $0 = \frac{0.738}{1} + \frac{15100 \text{ cm2}}{1}$ |
| Removable MDA = $\frac{2.71}{1} + 3.29(\frac{44}{1} + \frac{44}{1})^{1/2}$ |
| Removable $0 = \frac{2.71}{1} + 3.29(\frac{44}{1} + \frac{44}{1})^{1/2}$ $0 = \frac{0.738}{1} + \frac{15100 \text{ cm2}}{1}$ |
| Removable Only MDA = $\frac{2.71}{1} + 3.29(\frac{44}{1} + \frac{44}{1})^{1/2}$ $0.238 (15 100 \text{ cm2})$ MDA = $\frac{940 \text{ dpa/loocm}^2}{1}$ |
| Removable $Only$ O |
| Removable $On = \frac{2.71}{1} + 3.29(\frac{94}{1} + \frac{94}{1}) \frac{1}{1}$ $On = \frac{940 \text{ dpn} / 100 \text{ cm}^2}{1}$ METER SERIAL #: TS: TB: EFF: PROBE SIZE: |
| Removable $On = \frac{2.71}{1} + 3.29(\frac{94}{1} + \frac{94}{1})\%$ $On = \frac{940}{1} = $ |
| Removable Only MDA = $\frac{2.71}{1} + 3.29(\frac{44}{1} + \frac{44}{1})\%$ Only MDA = $\frac{940 \text{ dpafloocm}^2}{1}$ TS: |

| Ву: | 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

| Gri | d No. | <u>Activity</u> | 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 |
| Α- | 5 | 69 | 16 | 69 | 940 | 64 | 940 |
| Α- | 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 | V. | Direct β–γ |
|-----|--------|-----------------|-----------------|-----|----------------------------|
| Gri | id No. | <u>Activity</u> | Uncertainty * | MDA | Activity Uncertainty * MDA |
| Α- | 1 | 69 | 16 | 69 | 1366 79 1366 |
| A- | 2 | 69 | 16 | 69 | 1366 79 1366 |
| Α- | 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 |
| Α- | 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 | 1 366 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.

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

μ_e = value compared guideline value to determine 95% Confidence Level
 x_{ave} = calculated mean for a survey unit,
 t_{1-e,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 number of measurements within a survey unit used to determine x_{ave} and s_x.

$$x_{ave} = \frac{69}{1,699}$$

$$t_{1-\alpha,df} = \frac{1,699}{0}$$

$$s_{x} = \frac{0}{30}$$

$$\mu_{\alpha} = \frac{69}{1,699}$$

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.

| Individual Completing Form: _ | | L. | Vann | | Date: 12-7-94 |
|-------------------------------|---|----|-----------|-------|---------------|
| Reviewed By: | 4 | | _ Date: _ | 1/13/ | 195 |

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

Meter Ludlum 2270 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

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

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)

Σ x_i 28, 200

 $_{\rm n_c}$ 30

 $x_{ave} = 990$

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

 $x_{ave} = \underline{990} \qquad n_s = \underline{30}$

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

 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_e and x_s .

$$x_{\text{ave}} = \frac{940}{\frac{1}{699}}$$

$$t_{1-\alpha,\text{df}} = \frac{\frac{1}{699}}{0}$$

$$s_{x} = \frac{0}{1}$$

$$n_{s} = \frac{30}{940}$$

$$\mu_{\alpha} = \frac{940}{0}$$

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.

| Individual Completing Form: | <i>D.</i> | L. | Vann | Date: 12-7-94 |
|-----------------------------|-----------|----|---------|---------------|
| Reviewed By: Reviewed By: | | | Date: _ | 1/13/95 |

 Survey Unit
 level I formule
 Aren
 Date
 12-7-94

 Meter
 Lnd/nm
 2220
 Serial #
 \$0067

 Probe
 AC-3
 Serial #
 7/2582

 MDA
 69
 (dpm/100cm²)
 Survey Type
 Pirect
 X

 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)

Σ x_i 2070

n. 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

 $x_{ave} = 69 \qquad n_s = 30$

 $\Sigma (\mathbf{x}_{\text{ave}}^{-} \mathbf{x}_{i})^{2} = \mathcal{O} \qquad \mathbf{s}_{i} = \mathcal{O}$

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

 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 number of measurements within a survey unit used to determine x_e and x_e .

$$x_{\text{ave}} = \frac{\zeta \, 9}{l_{1-\alpha, \text{df}}}$$

$$t_{1-\alpha, \text{df}} = \frac{l_{1-\alpha, \text{df}}}{l_{1-\alpha, \text{df}}}$$

$$s_{x} = \frac{0}{l_{1-\alpha, \text{df}}}$$

$$n_{s} = \frac{3 \, 0}{l_{1-\alpha, \text{df}}}$$

$$\mu_{\alpha} = \frac{\zeta \, 9}{l_{1-\alpha, \text{df}}}$$

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.

| Individual Completing Form: | D. L. | Vann | Da | te: $\frac{12-7-94}{}$ |
|-----------------------------|----------|---------|---------|------------------------|
| Reviewed By: Reviewed By: | <i>f</i> | Date: _ | 1/13/95 | - |

Survey Unit level 1 Farance Area Date 12-7-94 Meter _______ Serial # ______ \$72.836 MDA /360 (dpm/100cm²) Survey Type Direct B-8Guideline Value ______ (dpm/100cm²)

Average Measurement Level

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

where:

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

Σx, 49720

 $x_{ave} = /657.3$

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

 $x_{ave} = \frac{1657.3}{}$ $n_s = \frac{30}{}$ $\Sigma (x_{\text{ave}}, x_i)^2 = \frac{1/\sqrt{c}/4987}{s_x} = \frac{632.9}{c}$

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

 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

 $n_s = number of measurements within a survey unit used to determine <math>x_{re}$ and s_{re}

$$x_{ave} = \frac{/657.3}{}$$

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

$$s_x = \frac{63Z.9}{}$$

$$n_s = 30$$

$$\mu_{\alpha} = 1853.6$$

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.

| Individual Completing Form: | D, | L, | Vann | Date: 12-7-94 |
|-----------------------------|----|----|-------|---------------|
| Reviewed By: L. K. | | 3 | Date: | 1/13/95 |

 Survey Unit
 Farnace
 Area
 Date
 12-7-94

 Meter
 Bicron
 Serial #
 B 218L

 Probe
 NA
 Serial #
 NA

 MDA
 NA
 (dpm/100cm²) Survey Type
 Exposure

 Guideline Value
 10 nRem /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)

 $\Sigma x_i / 47$

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

$$x_{ave} = 4.9$$
 $n_s = 30$
 $\sum (x_{ave} - x_i)^2 = 2.7$ $s_x = 0.3$

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

 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 s_x number of measurements within a survey unit used to determine s_x and s_x .

$$x_{ave} = 4,9$$

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

$$s_x = 0,3$$

$$n_s = 30$$

$$\mu_{\alpha} = 5,0$$

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.

| Individual Completing Form: | D, L, | Vann | Date: <u>/7-7-94</u> |
|-----------------------------|-------|---------|----------------------|
| Reviewed By: | | 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

| | P. L. Vann for | |
|---|--|---|
| SURVEYOR _ | Keyin Graczyk | DATE |
| REVIEWER _ | B Duli | TIME |
| SURVEY METERS MODEL & d / m ZZZO MO SERIAL # SCOG SEF CAL DUE 10-17-95 CAL EFFICIENCY 0. Z 38 EFF TYPE 44-9 TYPE | DEL Lad/4m 2270 RIAL # 500,67 DUE 10-17-95 FICIENCY 0,0667 PE AC-3 | MODEL Bicron SERIAL # BZ18L CAL DUE 10-14-95 EFFICIENCY IVA TYPE MicroRem |
| BKG 98 cpm BKC | 3 _ O pm | BKG Sulem /hr |
| BKG 98 cpm BKC MDA 1366 +360 dpm/100cm2 MD | A 69 Spm/100cm | 7 MDA // // |
| LOCATION: Banseh & Lumb Batch Re | | |
| | | SMEAR dpm/100 cm ² |
| | | # βγ α |
| | | see Attached |
| | | |
| | x | |
| Garage Door | | |
| B1 B2 B3 B4 B5 B | 6 87 88 89 | |
| H A2 A3 A4 A5 A6 | 6 A7 A8 A9 | |
| | | |
| | | -1 |
| | | |
| | | |
| | | |
| | | |
| | | |
| Grids Measure Imeter | b. meter | |
| NOTE: Smear results in dpm/100 cm² unles | ss otherwise noted. (1) denot | es / |
| smear location. An * followed by a redenotes direct probe readings in doing rates in mR/hr. | | om) |
| PURPOSE: Free Release Survey | / | |
| / | • | |

REMOVABLE CONTAMINATION

| DATE: | 12-11-94 | , | | , LOCATION | V: Banso | chslomb | Room No | rth hall |
|--|---------------------|-------------------|-----------|----------------|-------------------|-------------|---------|-------------------|
| | Ludlum 7: Ludlum | 2220 | 50067 X | Y EEEIOIENI | CV: 0,0 | 667 | 0,23 | 8 |
| COONTE | Model | | Number | CFFICIEN | Alp | | Beta/Ga | |
| | DPM/10 | 00cm ² | | DPM/10 |)0cm ² | | DPM/1 | 00cm ² |
| LOCATION | | α | LOCATION | βγ | α | LOCATION | βγ | α |
| A1 | £ 940 | L 69 | | | /- | | | |
| AZ | c 940 | c 69 | | | | | | |
| A-3 | c 940 | c 69 | | | | | | |
| A4 | c 940 | c 69 | | | | | | |
| A 5 | c 940 | C 69 | | | | | | |
| A-6 | c 940 | c 69 | | | / | | | |
| A7 | 2 940 | C 69 | | | | | | |
| A 8 | c 940 | c 69 | | | | | / | . , |
| A9 | < 940 | c 69 | | | • 1 | | | |
| BI | c 940 | c 69 | | | | | | |
| BZ | c 940 | C 69 | | | | | | |
| B.3 | < 940 | c 69 | | | | | | |
| B4 | L 940 | c 69 | | | | | | |
| B.S | c 940 | c 69 | | | | | | |
| BC | C 940 | c 69 | | | | | | |
| <i>B</i> 7 | < 940 | c 69 | | | | | | |
| B8 | L 946 | 269 | | | | | | |
| 89 | c 940 | C 69 | | | | | | |
| | N | | | | | | | |
| | A | | / | | | / | | |
| | | | | | α MDA (| dom/100cm (| 2) 69 | |
| ALPHA BKG COUNT RATE: Ο cpm βγ MDA (dpm/100cm 2) 940 | | | | | | | | |
| BETA/GAI | MMA BKG C | OUNT RA | TE: 44 cp | m | | • | | |
| | | | | SURVE | | D. L. | 5 | |

AVERAGE CONTAMINATION SURVEY RESULTS

| DATE: 12-11-94 | 7.3.2.2.2.2.2.7 | PROBE: AC-3 EFF: 0,0667 | | | |
|---|--|---------------------------------|--|--|--|
| INSTRUMENT: MODEL | NUMBER | PROBE: | | | |
| GRID NUMBER | dpm/100cm2 \ | GRID NUMBER dpm/100cm2 | | | |
| A1 | 2 69 | | | | |
| Az | c 69 | | | | |
| H3 | c 69 | | | | |
| AY | c 09 | | | | |
| AS | c 69 | | | | |
| + 6 | L 69 | | | | |
| A7 | c 69 | | | | |
| A 8 | < 69 | | | | |
| A9 | < 69 | N/ | | | |
| B/ | c 69 | TI A | | | |
| BZ | c 69 | | | | |
| 83 | c '69 | | | | |
| B 4 | c 69 | | | | |
| B.S | c 69 | /. | | | |
| BC | c 69 | | | | |
| B7 | C 69 | | | | |
| B8 | C 69 | | | | |
| 89 | C 69 | | | | |
| Ŋ | A | | | | |
| | Avera | ge Background counts per minute | | | |
| *BASED ON AVERAGE OF 5 DIRECT MEASUREMENTS (INITIAL DIRECT MEASUREMENT WAS GREATER THAN 60% OF GUIDELINE VALUE) | | | | | |
| 30 | | D. L. Vann for | | | |
| $\frac{\text{dpm}}{100\text{cm}^2} = \frac{\text{(gross count ra})}{\text{(efficience)}}$ | ate) - (background cou cy) (probe area) 100cm ² | SUPERVISOR Brule | | | |

AVERAGE CONTAMINATION SURVEY RESULTS

| DATE: | | LOCA | TION: Bausch + Land | 2 Rotch Room North Wall | |
|---|---|--|---------------------------|-------------------------|--|
| INSTRUMENT: Ludlum | NOMBER | | E: <u>44-9</u> E MODEL | | |
| GRID NUMBER | dpm/100cm2 | | GRID NUMBER | dpm/100cm2 | |
| Al | < 1366 | | | | |
| A2 | <136L | | | | |
| A3 | 21366 | | | | |
| AY | 41366 | | | | |
| A5 | 41366 | | | | |
| AG | <1366 | $\perp \parallel$ | | | |
| A7 | <1366 | $\perp \! \! \! \! \! \! \! \! \perp$ | | | |
| A8 | 61366 | | | | |
| | < 1366 | | Λ, | 1 | |
| BI | e1366 | Щ. | / | 1A | |
| <u> 32</u> | 41366 | | | | |
| K3 | 41366 | | | | |
| B 4 | <1366 | | | | |
| <u>B5</u> | <1366 | | | | |
| BL | 41366 | | | | |
| B7 | 41366 | - | | | |
| B8 | 41366 | _ - | | | |
| <u>B9</u> | <1366 | + | / | - | |
| | A | $\perp \! \! \! \! \! \! \! \! \! \! \! \! \! \! \! \! \! \! \!$ | | 00.10 | |
| | Aver | age Back | ground counts per mi | | |
| *BASED ON AVERAGE OF 5 DIRECT MEASUREMENTS (INITIAL DIRECT MEASUREMENT WAS GREATER THAN 60% OF GUIDELINE VALUE) | | | | | |
| | ate) - (background co | unt rate) | SURVEYOR 25 | RA | |
| 100cm ² (efficiend | cy) <u>(probe area)</u> 100cm ² | | SUPERVISOR Z | Sunder Sul- | |

EXPOSURE RATE SURVEY RESULTS

| DATE: 12-11-94 | | | OCATION: | Brisch + Lomb | Batch Rom | Northwall |
|--------------------|-----------------|------------|----------|---------------|---------------|---------------|
| INSTRUMENT: Bicros | B218L | | AL DUE: | 10-14-95 | | |
| GRID NUMBER | EXPOSUF μR/h | | G | RID NUMBER | EXPOSU μR/ | JRE RATE h |
| AI | 1cm | 5 1m/hr | | | 1cm | 1m |
| A2 | | 5 uRlha | | | | |
| A3 | | sur/hr | | | | |
| AY | | 5 uzlhr | | | | |
| A5 | | suzlh | | | | |
| AC | | suplhr | | | | |
| A7 | | 5uzlhr | | | | |
| A8 | | 642/hr | | | N/A | |
| A9 | | 6uR/hr | | | | |
| .31 | NA | sur hr | | | | |
| B2 | | 5uz/hr | | | | |
| B3 | | 2015/p | | | | |
| BY | | sughr | | | | |
| B5 | | suztho | | | | |
| BC | | SURIN | | | | |
| <i>B7</i> | | 547/hr | | | | |
| <i>B</i> 8 | | surthr | | | | |
| <i>B</i> 9 | | Cu2/hr | | | | |
| MEASUREMENTS TAKE | N AT 1cm ANE | D/OR 1m Al | BOVE THE | FLOOR. | | |
| | | | | | | |

BKG: 542/hr

MDA CALCULATION SHEET

| METER 2270 4449 SERIAL #: 5006/ |
|--|
| TS: / RB: 98cpm EFF: 0,238 PROBE SIZE: 15cm2 |
| MIDA = $\frac{2.71}{1} + 329(\frac{98}{1} + \frac{98}{1})\frac{1}{2}$ |
| 0,23 & (/ S/100 cm2) |
| MDA = 1366 dpm/100cm ² |
| METER 2220 W/A-3SERIAL #: 500 67 |
| TS: 1 RB: 0 cpm EFF: 0,0667 PROBE SIZE: S9 cm 2 |
| MDA = $\frac{2.71}{l} + 3.29(\frac{0}{l} + \frac{0}{l})\%$ |
| 0,0667 (59/100 cm2) |
| MDA = 69 dpo/100cm2 |
| METER 2220 7/4-9SERIAL #: 500G/ |
| TS: 1 TB: 1 RB: 44 cpm EFF: 0,238 PROBE SIZE: 15 cm 2 |
| Removable MDA = $\frac{2.71}{1} + 3.29(\frac{44}{1} + \frac{44}{1})\%$ |
| 01238 (15/100 cm2) |
| MDA = 940 dpm/100cm ² . |
| METERSERIAL #: |
| TS: PROBE SIZE: |
| MDA = 2.71 + 3.29(+) % |
| (/ 100 cm2) |
| MDA = |
| |
| Technician: 0, Ly Vann Date: 12-11-94 |

| Ву: | Date: | Project: 2278-300 | | | | |
|-------|-------|-------------------|--|--|--|--|
| Chkd: | Date: | Page #: | | | | |

Bausch & Lomb Release Survey Data

Survey Unit:

Batch Room North Wall

Activity (dpm/100cm^2)

Removable a

Removable β - γ

| G | rid No. | Activity | Uncertainty * | MDA | A ativity | . Unnostalut + | MOA |
|-----|---------|-----------------|---------------|-----|-----------|----------------|------------|
| | | | | | Activity | | <u>MDA</u> |
| A | | 69 | 16 | 69 | 940 | 64 | 940 |
| A. | | 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 |
| A٠ | . 7 | 69 | 16 | 69 | 940 | 64 | 940 |
| A- | - 8 | 69 | 16 | 69 | 940 | 64 | 940 |
| A- | . 9 | _: 69 | 16 | 69 | 940 | 64 . | 940 |
| B- | | 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.

| Ву: | 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 | | | | | |
|-----|-------|----------|-----------------|------|------------|----------|------|--|------|------------|------|----------|-----|------|--|
| Gri | d No. | <u> </u> | ctivity | Unce | ertainty * | <u>N</u> | /IDA | | Acti | vity | Unce | ertainty | * | MDA | |
| Α- | 1 | | 69 | | 16 | | 69 | | 13 | 66 | | 79 | === | 1366 | |
| Α- | 2 | | 69 | | 16 | | 69 | | 13 | 66 | | 79 | | 1366 | |
| A- | 3 | | 69 | | 16 | | 69 | | 13 | 66 | | 79 | | 1366 | |
| A- | 4 | | 69 | | 16 | | 69 | | 13 | 66 | | 79 | | 1366 | |
| A- | 5 | | 69 | | 16 | | 69 | | 13 | 66 | | 79 | | 1366 | |
| A- | 6 | | 69 | | 16 | | 69 | | 13 | 66 | | 79 | | 1366 | |
| A- | 7 | | 69 | | 16 | | 69 | | 13 | 66 | | 79 | | 1366 | |
| A- | 8 | | 69 | | 16 | | 69 | | 13 | 66 | | 79 | | 1366 | |
| Α- | 9 | | 69 | | 16 | | 69 | | 13 | 66 | | 79 | | 1366 | |
| B- | 1 | | 69 | | 16 | | 69 | | 13 | 66 | | 79 | | 1366 | |
| B- | 2 | | 69 | | 16 | | 69 | | 13 | 66 | | 79 | | 1366 | |
| B- | 3 | | 69 | | 16 | | 69 | | 13 | 66 | | 79 | | 1366 | |
| B- | 4 | | 69 | | 16 | | 69 | | 13 | 66 | | 79 | | 1366 | |
| B- | 5 | | 69 | | 16 | | 69 | | 13 | 66 | | 79 | | 1366 | |
| B- | 6 | | 69 | | 16 | | 69 | | 13 | 66 | | 79 | | 1366 | |
| B- | 7 | | 69 | | 16 | | 69 | | 13 | 66 | | 79 | | 1366 | |
| B- | 8 | | 69 | | 16 | | 69 | | 13 | 66 | | 79 | | 1366 | |
| B- | 9 | | 69 | | 16 | | 69 | | 13 | 66 | | 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.

Average Measurement Level

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

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 /8

 $X_{ave} = 69$

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

$$x_{ave} = \underline{69}$$
 $n_s = \underline{18}$

$$\sum (x_{ave} - x_i)^2 = \underline{5}$$
 $s_x = \underline{5}$