



# Rio Algom Mining LLC

February 16, 2007

Certified Mail  
Return Receipt (7004 0600 0028 3733 9776)

ADDRESSEE ONLY

Mr. Tom McLaughlin, Project Manager  
U.S. Nuclear Regulatory Commission  
Mail Stop T-7-E18  
Washington, DC 20555

Re: **License SUA-1473, Docket No. 40-8905**  
**2006 ALARA Review**

Dear Mr. McLaughlin,

In accordance with license condition #10 of the above referenced source material license and the *Health Physics and Environmental Programs Manual*, please find attached the 2006 ALARA Review for the Ambrosia Lake facility. This summary reviews the actions taken to maintain occupational exposures as low as reasonably achievable.

If you have any questions or need additional information, please do not hesitate to call me at (505) 287-8851.

Regards,

Peter Luthiger  
Manager, Radiation Safety  
and Environmental Affairs

Attachment: As Stated

xc: T. Fletcher  
S. Hancock (KGL)  
K. Lovato  
R. Powell  
Document Control (NRC)  
R. Rodriguez  
file

# **RIO ALGOM MINING LLC AMBROSIA LAKE FACILITY**

License SJA 1473 Docket 403905

# **ALARA REPORT 2006**

February 16, 2007

**ALARA SUMMARY**  
**January - December 2006**

**INTRODUCTION**

The annual ALARA summary for Rio Algom Mining LLC's Ambrosia Lake facility for calendar year 2006 is submitted for NRC's review in accordance with Quivira's Source Material License Condition #10. License condition #10 contains Rio Algom Mining LLC's ALARA Policy as well as the NRC approved health physics and environmental/effluent monitoring programs required to be implemented at the facility as specified within the *Health Physics and Environmental Programs Manual*.

The formal management ALARA review was conducted on February 15, 2007 by the facility ALARA audit committee. In attendance were Messrs. Terry Fletcher (General Manager), Peter Luthiger (Radiation Safety Officer), Rudy Rodriguez (Maintenance Foreman), Ron Powell (Reclamation Engineer), Kathy Lovato (Supervisor, Personnel and Administration) and Steve Hancock (KGL HSEC Representative).

The primary focus of activities at the site during calendar year 2006 was consolidating and transporting evaporation pond sediments associated with the Section 4 lined pond closure activities. This report is divided into two sections, each describing the radiation protection program activities and results. These sections are:

1. Rio Algom activities not associated with the lined pond project;
2. Lined Pond project

**Section 1 - Rio Algom Activities**

- I. Health Physics Sampling Summary
  - A. **Bioassay**

The collection of bioassay samples continued during the year in accordance with the policy statement prescribed in the Bioassay Program section of the facility *Health Physics and Environmental Programs Manual*. This manual outlines the health physics and environmental/effluent monitoring programs required to be implemented at the facility.

As a result of mill demolition, the potential for uranium intake has been reduced. To ensure that the ALARA principle is maintained, employees associated activities in the ion exchange plant and maintenance work continued to submit bioassay samples during 2006.

During the year there were a total of fifty four (54) routine samples collected from Rio Algom employees. Analytical results indicated that all sample concentrations were below the laboratory's lower detectable limit of five (5) micrograms per liter (ug/L) except for one sample.

All quality assurance spike samples were within the Regulatory Guide 8.22 suggested variance for acceptable spike result.

The reasons for the continued negligible bioassay concentrations are:

1. The site has completed mill demolition of the former yellowcake processing areas;
2. The work activities where potential exposures could occur are performed under radiation work permits to ensure appropriate radiological controls are instituted;
3. Airborne concentrations within the area are continually well below the DAC for soluble natural uranium.

These bioassay results corroborate the airborne yellowcake sampling program sampling results, which show very low airborne concentrations.

**B. Personnel Alpha Contamination Checks**

During 2006, forty one (41) random alpha contamination surveys were conducted of employees leaving the restricted area. These checks were performed by health physics personnel. The contamination checks were performed at the end of work shift prior to employees leaving the mill facility. All surveys were well below the 1000 disintegrations per minute per 100 square centimeters (dpm/100 cm<sup>2</sup>) guideline contained within NRC Regulatory Guide 8.30.

**C. Surface Contamination Checks**

There were 468 surface contamination checks performed during the review period. The surface contamination checks were performed at various places throughout the restricted area including lunch rooms, change rooms, and the guard office. All sample results were below the respective action levels.

**D. Radon Daughter Sampling**

During 2006, the annual radon daughter exposure for all employees was 0.0 working level months (wlm). The annual allowable occupational exposure limit is 4 wlm. It should also be noted that the radon concentrations measured are inclusive of background concentrations. As a result of mill demolition, the ion exchange plant was the only facility remaining on the quarterly sampling program for radon daughters.

1. Mill IX Plant

The average radon daughter concentration during 2006 was 0.01 wl. The 2005 average radon concentration averaged 0.02 wl. The 2006 average area concentration represents 3% of the DAC limit of 0.33 wl. Employee occupancy times within the ion exchange plant is typically less than 10 hours per week.

**E. Yellowcake Samples**

As an integral component of the health physics monitoring program outlined within License Condition #10, air sampling is performed to assess potential employee exposure to airborne yellowcake. With demolition of key process areas completed in February 2004, potential exposure was greatly reduced. As a result, sampling frequency was also reduced to quarterly.

There were 24 air samples taken during 2006 for airborne yellowcake activity. The samples, which were obtained at random times, indicated an annual average concentration for 2006 less than 1% of the DAC for soluble natural uranium.

**F. Uranium Ore Dust**

During the review period, there were no routine uranium ore dust samples taken as the crushing circuit was demolished in late 2003.

### G. **Gamma Surveys**

There were two semiannual gamma surveys conducted during the year as suggested by Regulatory Guide 8.30 and all areas surveyed were properly posted in accordance with 10 CFR 20.1902 and License Condition 28.

## II. Respiratory Protection Program

The facility *Respiratory Protection Program* was reviewed to evaluate the effectiveness of the program in limiting exposures to individuals. This review included evaluating air sampling data, use of engineering controls, bioassay results, and employee acceptance of the using the equipment. The review determined that, when required, respirators were effective in minimizing employee exposure to radioactive materials.

All employees received refresher training the on respiratory protection program. Spirometry testing by a physician indicated that all employees requiring physicals have been deemed physically fit to use respiratory protection equipment. No complaints or comments were received by employees regarding problems with equipment. During 2006, respirators were not required on any task performed by Rio Algom employees.

Air sampling data continues to indicate that airborne concentrations are well below the DAC for soluble natural uranium. This is attributable to demolishing the mill and following established procedures.

Bioassay results were reviewed to evaluate the effectiveness of the air sampling program presently in place at the facility. Excluding the suspect sample, all analytical results were below the laboratory's lower detectable limit of five (5) micrograms per liter (ug/L), reinforce that the air sampling program is effective in evaluating the airborne concentrations in the work areas and that employees are following established procedures, adhering to special work requirements.

## III. Exposure Summary

All licensees are required to ensure compliance with the occupational dose limits specified within 10 CFR 20.1201(a). This regulation establishes an annual limit based on internal exposures as well as external exposures. Annual exposure to employees are determined by calculating exposures to radon daughters, soluble airborne yellowcake dust, and gamma

radiation. Each component of the annual exposure is discussed in more detail in subsections A through D below.

**A. Total Effective Dose Equivalent**

The total effective dose equivalent (TEDE) exposure results for all employees is presented in Table 1 below. The TEDE is the sum of the deep dose equivalent (external exposures) and the committed effective dose equivalent (internal exposures).

The highest TEDE exposure for a Rio Algom employee for 2006 was 0.045 Rems. This exposure represents less than 1% of the annual allowable occupational dose limit specified within 10 CFR 20.1201(a). Review of the results indicates that the TEDE is comprised primarily of the deep dose equivalent component.

Appendix A, Chart 1 contains the maximum annual TEDE exposures for employees for the time period covering 1990 to 2006. The chart demonstrates that occupational exposures are being maintained ALARA.

TABLE 1  
2006 TOTAL EFFECTIVE DOSE EQUIVALENT (TEDE)

Exposure (REM)	0 -.005	.006 -.010	.011 -.050	> 0.050
No. of Employees	15	5	3	0

10 CFR 20.1502 requires exposure monitoring of any individual likely to receive a dose in excess of 10% of the occupational dose limits prescribed in 10 CFR 20.1201. Based on the annual exposures determined for facility personnel, individual exposure monitoring of visitors will not be necessary.

**B. Deep Dose Equivalent (Gamma Exposure)**

Gamma exposures are determined by the results of personnel dosimetry worn by all employees and analyzed in accordance with National Voluntary Laboratory Accreditation Program (NVLAP) procedures and specifications by an accredited outside contract laboratory. Table 2 summarizes the 2006 employee gamma dose exposures. The highest annual gamma exposure incurred by an

employee was 0.101 Rem, which represents 2% of the annual allowable occupational dose limit.

Appendix A Chart 2 contains the maximum annual deep dose equivalent exposures for the time period covering 1990 to 2006. The chart demonstrates that occupational external radiation exposures are being maintained ALARA.

TABLE 2  
2006 DEEP DOSE EXPOSURES

Exposure (REM)	0 -.005	.006 -.010	.011 -.050	> 0.050
No. of Employees	15	5	3	0

**C. Radon Daughter Exposures**

Air samples are obtained in accordance with the facility sampling program outlined within the NRC approved Health Physics and Environmental Programs Manual. Occupancy times are then factored into these values in order to obtain an employee's internal exposure to radon daughters for that time period.

All employee radon daughter exposures during 2006 were 0.0 wlm. The annual allowable occupational exposure limit is 4 wlm. These exposures are the result of reduced production within the ion exchange plant and demolition of the mill. The annual radon daughter exposure results are presented below in Table 3.

TABLE 3  
2006 RADON DAUGHTER EXPOSURES

Exposure (wlm)	0.0	0.1-0.5	0.6-1.0	> 1.0
No. of Employees	23	0	0	0

Appendix A Chart 3 contains a chart depicting the maximum annual radon daughter exposures for the time period covering



1990 to 2006. The chart demonstrates that occupational exposures to radon are being maintained ALARA.

**D. Yellowcake and Uranium Ore Dust**

Internal exposures to soluble uranium are determined by analyzing the yellowcake samples for gross alpha activity to obtain an average air concentration for the area. Air samples are obtained in accordance with the facility sampling program as well as from radiation work permits which may require personnel sampling. Occupancy times are then factored into these values in order to obtain an employee's internal exposure for that time period or task.

Table 4 summarizes the 2006 employee internal exposures to soluble uranium. Due to no activity occurring in 2006 associated with uranium/yellowcake activity, no employee exposures were incurred. Appendix A Chart 4 contains a chart depicting the maximum annual exposures to uranium for the time period covering 1990 to 2006. The chart demonstrates that occupational exposures to uranium are being maintained ALARA.

TABLE 4  
2006 SOLUBLE URANIUM (YELLOWCAKE) EXPOSURES

Exposure (DAC-Hr)	0	0.1-1.0	1.01-2.0	> 2.0
No. of Employees	23	0	0	0

**IV. Miscellaneous ALARA Activities**

**A. Health, Safety, Environment and Community Management System Implementation**

Implementation of the corporate wide Health, Safety, Environment and Community Management environmental management system continued throughout 2005. The management system provides a framework for personal, site and corporate HSEC

responsibility and leadership and ensures the continued improvement of HSEC programs and performance.

Integration of the ALARA principle into the site HSEC management system has provided an additional mechanism to monitor progress toward continued improvement in HSEC activities.

Key improvements involved increased employee awareness, incorporating the concept of performing job safety analyses, and expanding the task observation program so that potential exposure concerns are identified and addressed prior to initiation of work.

**B. Daily and Weekly Inspections**

During the year, daily inspections did not result in any mill corrective orders being issued. Mill corrective orders (MCO) are normally issued when an area requires clean up and that item involves radiological conditions which are below the recommended regulatory guide limits. Mill corrective orders are issued when the job does not require a radiation work permit (RWP).

No RWPs were issued during 2006. Exposures associated with this RWP were negligible as a result of the use of appropriate controls designed to minimize employee exposure. Job safety analyses were typically performed prior to initiation of work to identify potential hazards expected to be encountered with appropriate mitigation controls implemented.

Weekly inspections of pertinent mill areas by the radiation safety officer are performed to observe and ensure that general radiological control practices are being used. The weekly inspections did not identify any unusual conditions or situation that required corrective action.

**C. Safety and Training Activities**

The annual eight (8) hour refresher course was completed for all employees and included the topics as outlined in Rio Algom Mining LLC's "Radiation Safety Training Program".

In addition to the annual refresher course, all employees and the contract security force successfully completed an 8 hour first aid training session during 2006.

All employees receiving physicals were administered a pulmonary function evaluation during 2006. Results from these spirometry tests indicated that all current employees are medically qualified to wear respiratory protection equipment.

Safety meetings, conducted throughout the year, reviewed various topics pertaining to radiation safety including the upcoming implementation of the company HSEC management system, contamination control, personnel dosimetry, the importance of reporting radiological hazards, personnel survey procedures, bioassay procedures, and the importance of practicing good personal hygiene and housekeeping while working in the mill area to ensure exposures remain ALARA.

**D. Performance of Emission Control Equipment**

The facility emission control equipment was demolished in late 2006.

**E. Operational Procedures & Emergency Response Actions**

During the year, all Standard Operating Procedures (SOP) and Emergency Response Procedures were reviewed and updated, if necessary, to ensure that proper radiation protection principles are applied. In addition, all procedures utilized within the radiation safety program were reviewed and updated, as necessary.

## **Section 2 –Lined Pond Closure Project**

The following review provides a comprehensive summary of all health physics and radiological monitoring performed as part of the Lined Pond closure project occurring in 2006. Work activities consisted of dewatering activities, sediment consolidation work, loading and hauling materials, compaction and geotechnical testing of the disposed material. All activity occurred under radiation work permits (RWP) or standard operating procedures (SOP).

As a result of establishing radiological exposures controls through the RWP and SOPs as well as conducting job safety analyses prior to commencing work activities, the project is proceeding without incident and occupational exposures to radioactive materials are being maintained ALARA.

### **I. Health Physics Sampling Summary- Lined Pond Closure Project**

#### **A. Bioassay- Lined Pond Closure Project**

Bioassay samples were collected during the lined pond project in accordance with the Bioassay Program established at the site.

A total of 520 bioassay samples were collected from contractor employees in calendar year 2006 associated with the Lined Pond Closure project. Analytical results indicated that all sample concentrations were below the laboratory's lower detectable limit of five (5) micrograms per liter (ug/L).

All quality assurance spike samples were within the Regulatory Guide 8.22 suggested variance for acceptable spike result.

#### **B. Personnel Contamination Checks – Lined Pond Closure Project**

There were 8313 contamination surveys of contractor employees. All surveys were below the 1000 disintegrations per minute per 100 square centimeters (dpm/100 cm<sup>2</sup>) guideline contained within NRC Regulatory Guide 8.30. Rio Algom utilized an action level of one half the allowable limit for personnel to ensure ALARA principle is maintained. Additionally, Rio Algom Health physics personnel randomly surveyed contractor personnel (516 additional surveys performed) during the project and all checks were below the action limits specified above.

Success in controlling contamination at the site can be attributed to job design, contractor employees utilizing their radiation safety training, following established work procedures including housekeeping, and practicing good personal hygiene.

C. **Radon Daughter Sampling – Lined Pond Closure Project**

As a result of the work being performed in an outdoor environment, no radon daughter sampling was conducted in areas associated with Lined Pond Closure Project activities. Radon daughter sampling was initiated upon establishing the contractor control point near the Section 4 ponds in late January 2006.

The average radon daughter concentration during 2006 was 0.0 w/l for areas sampled during the year. Areas included the office trailers used by KGL related personnel and the soils lab used for construction quality assurance activities.

D. **Uranium Sampling – Lined Pond Closure Project**

Rio Algom collected 258 area air samples associated with the Lined Pond Closure Project that were analyzed for airborne uranium concentrations. Results of these samples indicated an average concentration of less than 1% of the limit. The minimal concentrations can be attributed to the outdoor environment and contractor personnel following procedures.

II. Exposure Summary – Lined Pond Closure Project

All licensees are required to ensure compliance with the occupational dose limits specified within 10 CFR 20.1201(a). This regulation establishes an annual limit based on internal exposures as well as external exposures. Annual exposure to contractor employees are determined by calculating exposures from airborne dust, and gamma radiation. Each component of the annual exposure is discussed in more detail in subsections A through C below.

A. **Total Effective Dose Equivalent – Lined Pond Closure Project**

The total effective dose equivalent (TEDE) exposure results for all contractor employees participating in Lined Pond Closure activities is presented in Table 5 below. The TEDE is the sum of the deep dose

equivalent (external exposures) and the committed effective dose equivalent (internal exposures).

The highest employee TEDE exposure for 2006 was 0.543 Rems. This exposure represents 11% of the annual allowable occupational dose limit specified within 10 CFR 20.1201(a).

TABLE 5  
LINED POND CLOSURE PROJECT  
2006 TOTAL EFFECTIVE DOSE EQUIVALENT (TEDE)

Exposure (REM)	0 -.100	.101 -.200	.201 -.400	.401 -.600	> 0.600
No. of Employees	13	8	13	22	0

**B. Deep Dose Equivalent (Gamma Exposure) - Lined Pond Closure Project**

Gamma exposures are determined by the results of personnel dosimetry worn by all contractor employees and analyzed in accordance with National Voluntary Laboratory Accreditation Program (NVLAP) procedures and specifications by an accredited outside contract laboratory. Table 6 summarizes the contractor employee gamma dose exposures. The highest deep dose gamma exposure incurred by a contractor employee working on the lined pond closure project was 0.049 Rem.

TABLE 6  
LINED POND CLOSURE PROJECT  
2006 DEEP DOSE EXPOSURES

Exposure (REM)	0 -.005	.006 -.010	.011 -.050	> 0.050
No. of Employees	33	15	15	0

C. **Airborne Sampling Exposure Results – Lined Pond Closure Project**

Internal exposures to radionuclides are determined by analyzing the samples for gross alpha activity to obtain an average air concentration for a designated task. Due to the size of the contractor work force, air sampling was performed for each task and the exposure result determined for that sample result was assigned to each individual in the same task assignment.

Table 7 summarizes the 2006 employee internal exposures to radionuclides associated with the lined pond closure project. The maximum exposure incurred by a contractor employee was 0.524 mRem, or 10% of the allowable limit.

TABLE 7  
LINED POND CLOSURE PROJECT  
2006 AIRBORNE SAMPLING EXPOSURE

Exposure (wlm)	0 -.100	.101 -.200	.201 -.400	.401 - .600	> 0.600
No. of Employees	14	7	17	18	0

III. Miscellaneous ALARA Activities – Lined Pond Closure Project

A. **Daily and Weekly Inspections – Lined Pond Closure Project**

During the demolition project, daily inspections did not result in any abnormal or unacceptable conditions requiring corrective action.

Weekly inspections of active work areas by the radiation safety officer were performed to observe and ensure that general radiological control practices are being used. The weekly inspections did not identify any unusual conditions or situation that required corrective action.

C. **Safety and Training Activities – Lined Pond Closure Project**

All applicable radiological safety training was administered to contractor employees prior to any employee initiating work on the lined pond closure project. This training, conducted by the site radiation safety officer, consisted of topics as outlined in Rio Algom

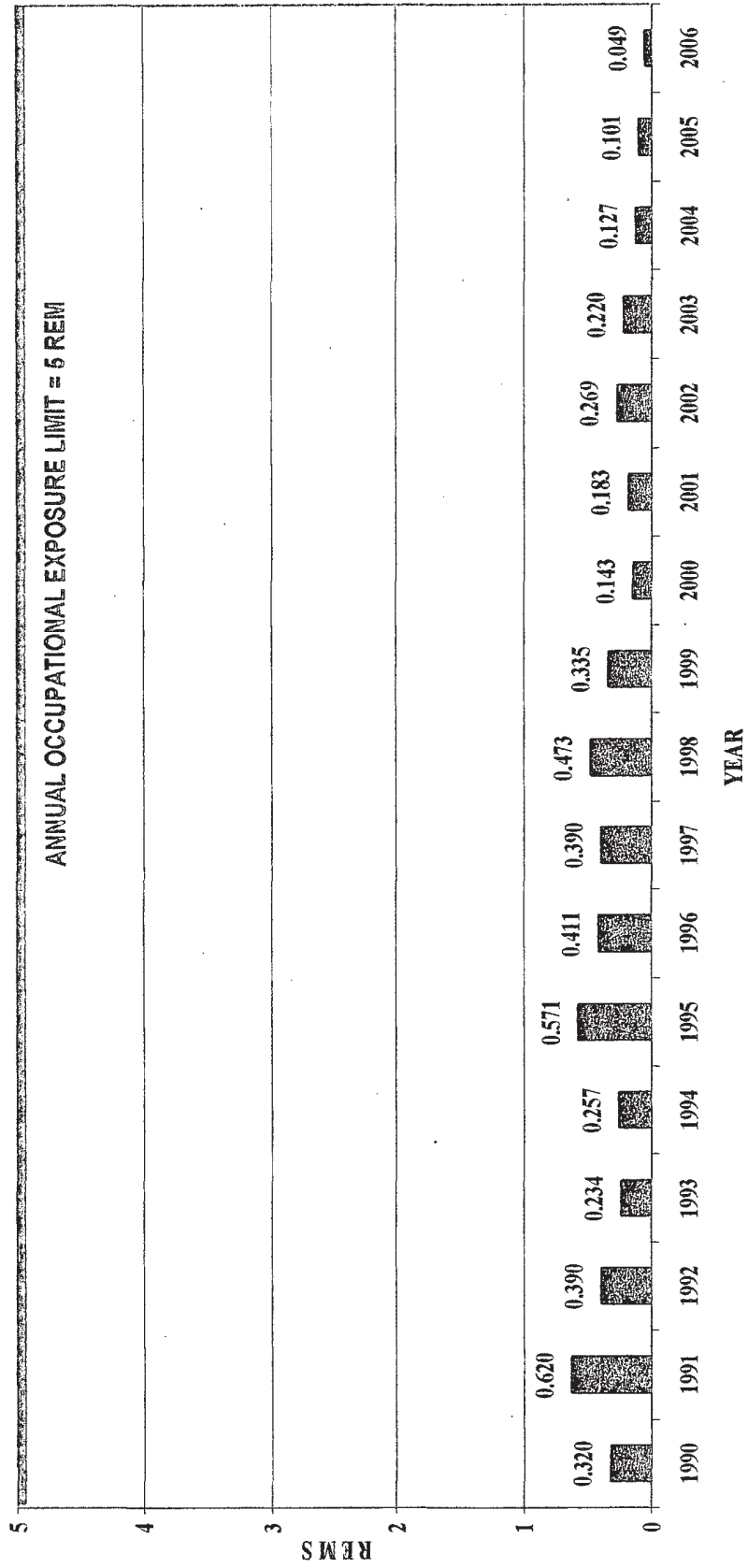
Mining LLC's Radiation Safety Training Program. Safety meetings were conducted daily.

The contractor Health and Safety representative reviewed various topics pertaining to safety, while the site Radiation Safety Officer highlighted radiation safety information such as contamination control, personnel dosimetry, the importance of reporting radiological hazards, personnel survey procedures, bioassay procedures, and the importance of practicing good personal hygiene and housekeeping while working in the mill area to ensure exposures remain ALARA.

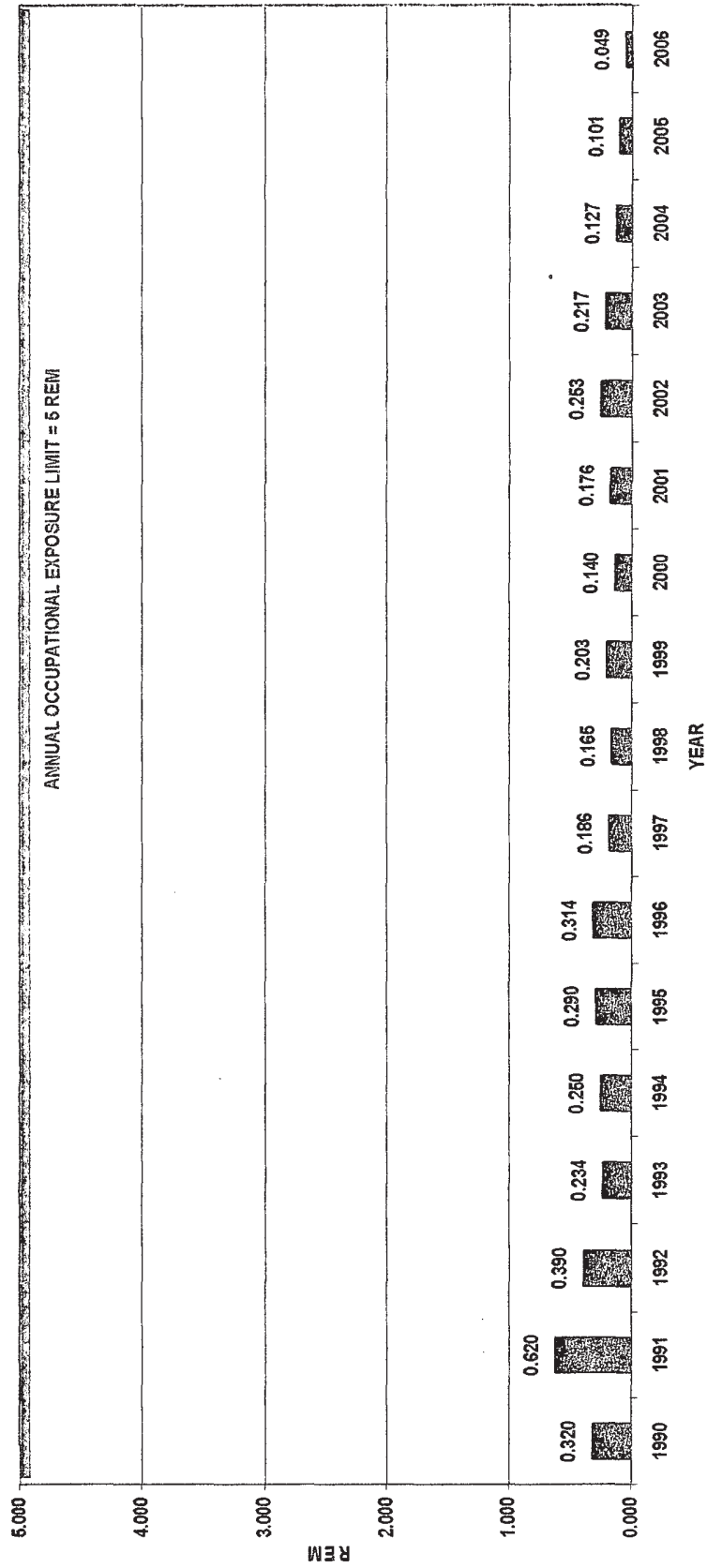


APPENDIX A

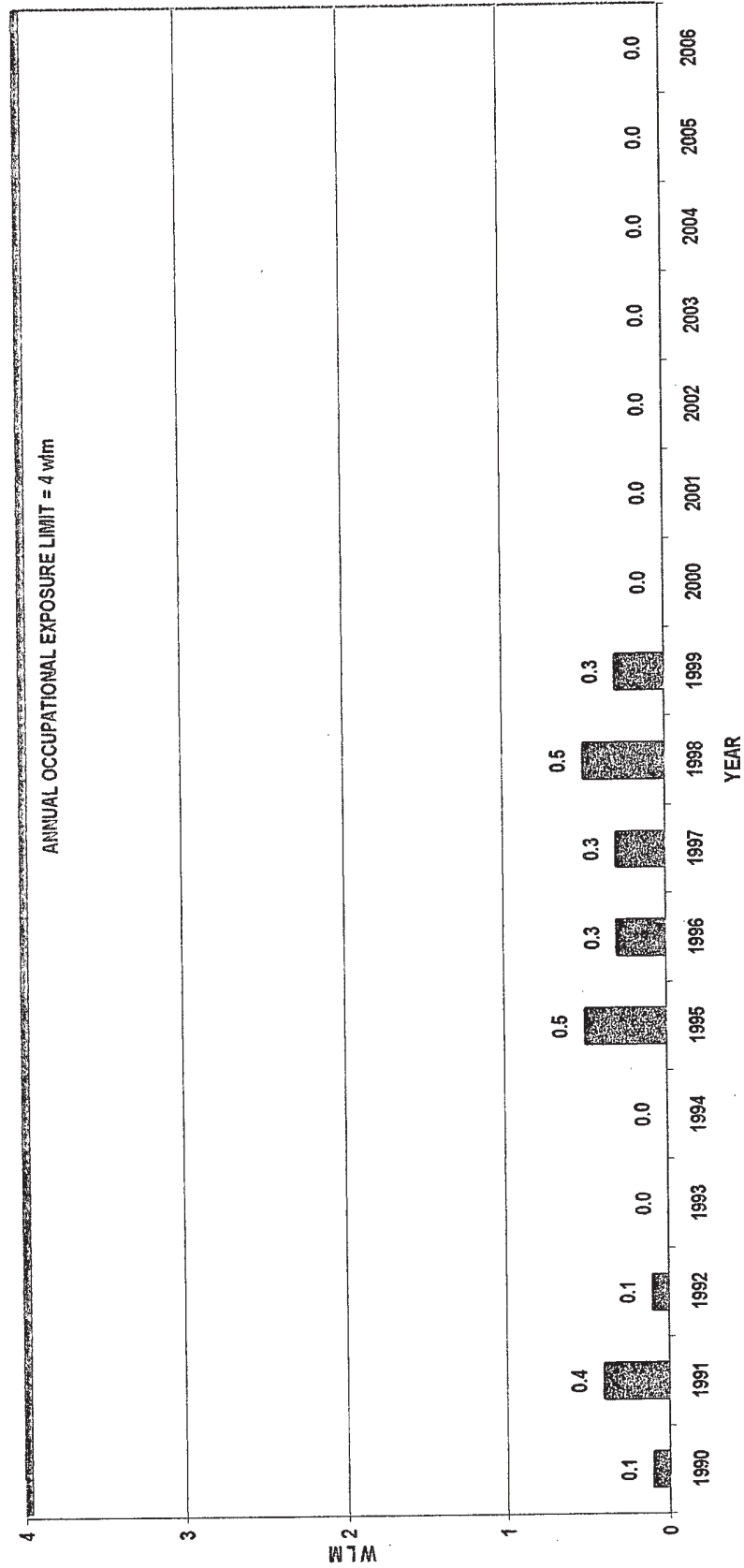
**CHART 1**  
**ANNUAL TEDE EXPOSURE**  
**MAXIMUM EXPOSURE FOR ANY EMPLOYEE**



**CHART 2**  
**ANNUAL EXTERNAL RADIATION EXPOSURE**  
**MAXIMUM DEEP DOSE EXPOSURE LEVEL FOR ANY EMPLOYEE**



**CHART 3  
RADON DAUGHTER EXPOSURES  
MAXIMUM EXPOSURE FOR ANY EMPLOYEE**



**CHART 4**  
**ANNUAL INTERNAL YELLOWCAKE DUST EXPOSURE LEVELS**  
**MAXIMUM EXPOSURE FOR ANY EMPLOYEE**

