Rio Algom

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February 19, 2002

Certified Mail
Return Receipt (7009 3400 0014 5548 6388)

Mr. M. Leach, Chief
Fuel Cycle Licensing Branch, NMSS
Mail Stop T-8-A-33
One White Flint North
11555 Rockville Pike
Rockville, MD 20850

Re: **License SUA-1473, Docket No. 40-8905**
2001 ALARA Review

Dear Mr. Leach,

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 2001 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.

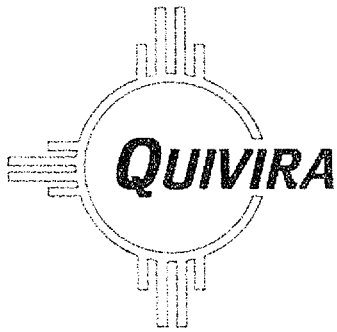
Regards,

Peter Luthiger
Supervisor, Radiation Safety
and Environmental Affairs

Attachment: As Stated

xc: A. Delgado
T. Fletcher
P. Goranson
K. Lovato
R. Powell
R. Rodriguez
file

NMSS/Public



QUIVIRA MINING COMPANY
Ambrosia Lake Facility

License SUA-1473 Docket No. 40-8905

ALARA REPORT
CALENDAR YEAR 2001

February 18, 2002

ALARA SUMMARY
January - December 2001

I. Introduction

The annual ALARA summary for Quivira Mining Company's Ambrosia Lake facility for calendar year 2001 is submitted for NRC's review in accordance with Quivira's Source Material License Condition #10. License condition #10 contains Quivira Mining Company'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 19, 2002 by the facility ALARA audit committee. In attendance were Messrs. Terry Fletcher (General Manager), Peter Luthiger (Radiation Safety Officer), Alberto Delgado (Supervisor Mill Operations), Rudy Rodriguez (General Maintenance Foreman), Ron Powell (Reclamation Engineer), and Kathy Lovato (Supervisor, Personnel and Administration). Copies of the review were also sent to corporate management.

II. 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 approved by the NRC.

The policy statement requires yellowcake operators to submit samples at least quarterly with the frequency increasing to semimonthly should airborne concentrations within the area exceed 25 percent of natural uranium Derived Air Concentration (DAC) listed in the revised 10 CFR 20, Appendix B, Table 1.

During the year there were a total of forty one (41) routine samples collected from individuals. 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 results except for the 3rd quarter low range spike sample, which was just outside the ± 30% acceptable range. Evaluation of sample preparation procedures and contact with laboratory to investigate the cause resulted in a reanalysis of the sample with the re-run falling within acceptable levels.

The reasons for the continued negligible bioassay concentrations are:

1. The process is in slurry form;
2. The operators normally spend less than ten (10) hours per week in the yellowcake area;
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 the review period, there were a total of Ninety four (94) random alpha contamination surveys 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^2) guideline contained within NRC Regulatory Guide 8.30.

In addition to the random employee surveys by health physics personnel, there were 1400 self monitoring checks by the employees. All checks indicated that contamination on personnel and their clothing were also below Regulatory Guide 8.30 suggested limits when leaving the facility.

C. Surface Contamination Checks

There were 260 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 2001, 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.

1. Mill IX Plant

The average radon daughter concentration during 2001 was 0.03 wl. The 2000 average radon concentration averaged 0.02 wl. The 2001 average area concentration represents 9% of the DAC limit of 0.33 wl.

Attached in Appendix A is a graph plotting the minimal radon daughter concentration average within the mill IX plant. The trend line is relatively flat, which indicates the minimal radon concentrations are essentially constant through time. This slight increase, especially near the end of the year, has been attributed to winterizing the facilities and cold weather creating occasional inversion conditions within the valley.

2. Yellowcake Precipitation Area

During 2001, the yellowcake precipitation area had an average radon daughter concentration of 0.02 wl. This represents 6% of the DAC limit of 0.33 wl. The 2001 average radon concentration for this area continued their negligible levels; as the 2000 average concentration for the area was also 0.02 wl.

Attached in Appendix A is a graph plotting the radon daughter concentrations average within the yellowcake area. The linear regression line or trend line is relatively horizontal indicating that the minimal radon daughter concentrations are constant through time.

3. Chemistry Lab

The radon daughter concentration average for the year was 0.02 wl which equates to 6% of the DAC limit of 0.33 wl. The 2000 average concentration for the area was also 0.02 wl.

As shown in the Appendix A, the trend line is relatively horizontal indicating that the minimal airborne concentrations are remaining constant through time.

4. Leach Building

The radon daughter concentration average for 2001 at the leach building was 0.04 wl, which represents 12% of the DAC limit of 0.33 wl.. The 2000 average for the area was 0.03 wl, indicating that the average concentrations are remaining relatively constant through time.

Attached in Appendix A is a trend line of the concentrations for the leach building. The trend line is slightly positive, which indicates the radon concentrations are increasing slightly through time. This slight increase in the minimal radon daughter concentrations, especially near the end of the year, has been attributed to winterizing the facilities and cold weather creating occasional inversion conditions within the valley. Some work activity being conducted in this area under a radiation work permit (crushing damaged yellowcake drums) is not attributed to this minor increase in average concentrations.

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. There were 144 routine air samples taken during 2001 for airborne yellowcake activity within the yellowcake precipitation area. The samples; which were obtained at random times at twelve locations within the precipitation area, indicated an annual average concentration for 2001 of 3.9×10^{-12} microcuries per milliliter (uCi/mL), which represents less than 1% of the DAC for soluble natural uranium. In comparison, the 2000 annual average

was 2.1 x 10^{-12} uCi/mL, which is less than 0.5% of the DAC for soluble natural uranium.

The average airborne concentrations are shown in graphical format within Appendix A. As indicated from the graph, the line is horizontal indicating that the minimal airborne concentrations for yellowcake dust remain constant over time and are well below the allowable limit of 5.0 x 10^{-10} uCi/mL for soluble uranium.

F. Soluble Uranium Intake

To demonstrate compliance with 10 CFR 20.1201(e), which limits soluble uranium intake to 10 milligrams per week, intake values were determined for the yellowcake area by utilizing data obtained from the air sampling program. For conservatism, the intake values assume continuous occupancy (40 hours) within the area. Actual occupancy times, and therefore, actual exposure, average around 15 to 20 hours per week.

The intake from soluble uranium, based on continuous occupancy, is presented in Appendix A. During 2001, the average intake of soluble uranium was 0.28 milligrams per week (assuming continuous occupancy); with a maximum intake for one week of 0.47 milligrams per week (assuming continuous occupancy). This projected intake is less than 5% of the allowable weekly limit of 10 milligrams.

G. Uranium Ore Dust

During the review period, there were no routine uranium ore dust samples taken as the crushing circuit has been shutdown with the area in standby.

H. Gamma Surveys

There were two semiannual gamma surveys conducted during the year as suggested by Regulatory Guide 8.30. A total of 42 different locations were checked throughout the mill and all areas surveyed were properly posted in accordance with 10 CFR 20.1902.

III. 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 on respiratory protection program including a fit test to determine the best respirator size for each employee. Spirometry testing by a physician indicated that all employees have been deemed physically fit to use respiratory protection equipment. No complaints or comments were received by employees regarding problems with equipment.

During 2001, various jobs required placement of special controls on the work procedures to ensure employee exposures were minimized. These jobs, which were issued as radiation work permits, utilized engineering controls (ventilation, enclosures, and additional accesses) as the primary method to control employee exposures. Respiratory protection was utilized only if an exposure potential still existed after use of engineering controls. Air sampling results indicated that exposures on these jobs were negligible.

Air sampling data continues to indicate that airborne concentrations are well below the DAC for soluble natural uranium. The airborne concentrations, which are shown in graphical format within Appendix A, indicate that the minimal airborne concentrations for yellowcake dust remain constant over time. This is attributable to maintaining the process in slurry form, following established procedures, and the use of proper controls on special jobs where employee exposure may occur.

Bioassay results were reviewed to evaluate the effectiveness of the air sampling program presently in place at the facility. Analytical results, all of which 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.

IV. 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 employee TEDE exposure for 2001 was 0.183 Rems. This exposure represents less than 4% 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 contains a chart depicting the maximum annual TEDE exposures for the time period covering 1990 to 2001. The chart demonstrates that occupational exposures are being maintained ALARA.

TABLE 1
2001 TOTAL EFFECTIVE DOSE EQUIVALENT (TEDE)

Exposure (REM)	0 -.05	.051 -.10	.101 -.50	.501-1.0	1.01-5.0	> 5.0
No. of Employees	16	0	3	0	0	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 2001 employee gamma dose exposures. The highest annual gamma exposure incurred by an employee was 0.176 Rem.

TABLE 2
2001 DEEP DOSE EXPOSURES

Exposure (REM)	< .05	.051-.10	.101-.20	.201-.50	.501-.75	> .75
No. of Employees	16	0	3	0	0	0

Appendix A contains a chart depicting the maximum annual deep dose equivalent exposures for the time period covering 1990 to 2001. The chart demonstrates that occupational external radiation exposures are being maintained ALARA.

C. Radon Daughter Exposures

All radon daughter exposures for employees are calculated using a time weighted average format as outlined by the Mine Safety and Health Administration (MSHA) in 30 CFR 57.5040. Air samples are obtained in accordance with the facility sampling program outlined within the NRC approved Health Physics and Environmental Programs Manual at various work locations throughout the facility. 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 2001 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. The annual radon daughter exposure results are presented below in Table 3.

TABLE 3
2001 RADON DAUGHTER EXPOSURES

Exposure (wlm)	0.0	0.1-0.3	0.31-0.6	0.61-0.8	0.81-1.0	> 1.0
No. of Employees	19	0	0	0	0	0

Appendix A contains a chart depicting the maximum annual radon daughter exposures for the time period covering 1990 to 2001. 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 2001 employee internal exposures to soluble uranium. The maximum exposure received by an employee during 2001 was 2.6 derived air concentration-hour (DAC-Hr); which corresponds to less than 1% of the annual limit of intake (ALI) for soluble natural uranium of 2000 DAC-Hr.

TABLE 4
2001 SOLUBLE URANIUM (YELLOWCAKE) EXPOSURES

Exposure (DAC-Hr)	0 - 0.1	0.11-1.0	1.01-2.5	2.51-5.0	5.01-10.0	> 10.0
No. of Employees	9	6	3	1	0	0

Due to the minimal airborne concentrations, all exposures to internal radionuclides are significantly below 25% of the DAC limit. The average yellowcake airborne concentration during the year was 1% of the DAC limit.

Appendix A contains a chart depicting the maximum annual exposures to yellowcake dust for the time period covering 1994 to 2001. The chart demonstrates that internal exposures to yellowcake dust are continually being maintained ALARA.

E. Yellowcake Slurry

No yellowcake slurry shipments were conducted in 2001.

F. Crushed Yellowcake Drums

During 2001, fifty four (54) shipments of crushed yellowcake drums were received from Honeywell. No problems were encountered during the receipt of the material. Activities were conducted under a standard operating procedure established for receiving byproduct material.

G Byproduct Material

During 2001, Quivira received four shipments of byproduct material from Rio Algom's Smith Ranch Facility as authorized by Quivira's NRC license condition #36. No problems or concerns were encountered during the receipt of the material. Activities were conducted under a standard operating procedure established for receiving byproduct material.

IV. Miscellaneous ALARA Activities

A. Environmental Health & Safety Management System Implementation

Implementation of the corporate wide environmental health and safety (EHS) management system continued throughout 2001. The management system provides a framework for personal, site and corporate EHS responsibility and leadership and ensures the continued improvement of EHS programs and performance. Integration of the ALARA principle into the site EHS management system will provide an additional mechanism to monitor progress toward continued improvement in EHS activities. Key improvements involved increased employee awareness and incorporating the concept of performing job safety analyses so

that potential exposure concerns are identified and addressed prior to initiation of work.

B. **Daily and Weekly Inspections**

During the year, daily inspections resulted in two 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).

The mill corrective order involved wiping down some visible yellowcake contamination on the lab bench within the yellowcake assay room. The orders have been filed for future reference and inspection.

A total of nine (9) RWPs were issued during 2001 involving various tasks associated with the ion exchange system and yellowcake precipitation process. Exposures associated with these RWPs were negligible as a result of the use of appropriate controls designed to minimize employee exposure.

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 Quivira Mining Company's "Radiation Safety Training Program". In conjunction with the annual refresher course, all employees completed a respirator fit test.

In addition to the annual refresher course, all employees and the contract security force successfully completed an 8 hour first aid training session during 2001.

All employees receiving physicals were administered a pulmonary function evaluation during 2001. 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 implementation of the company EHS 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

Due to no yellowcake drying activities occurring in 2001, the facility emission control equipment such as the wet scrubber and the baghouse were not operated.

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. As part of this review, emergency telephone numbers were verified to ensure accurate and prompt notification channels are in place.

In addition, all procedures utilized within the radiation safety program were reviewed and updated, as necessary.

F. Miscellaneous ALARA Related Activities

In response to the events of September 11, 2001, and a October 16, 2001 directive from NRC, an evaluation of possible threats to activities authorized under the license was conducted. This evaluation commenced on September 25, 2001. The NRC license was reviewed to determine whether any modifications to the existing license, programs, or procedures were needed to ensure appropriate safeguards. Actions included a review of the licensed activities, quantity of material present or expected to be on site,

level of activity, existing control measures, security services, and regulatory requirements.

The findings of this evaluation resulted in deeming the existing controls are appropriate based on the probability/potential threat and the availability/use of materials. Vendors/visitors will be escorted, as needed to ensure that no unauthorized personnel are on site without company personnel observing visitor activities. The primary risk identified was not associated with the NRC license but centered around the remaining explosives at the operation. These explosives were destroyed by the New Mexico State Police Bomb Squad in a training exercise in November 2001.

APPENDIX A

Time Versus Concentration Plots

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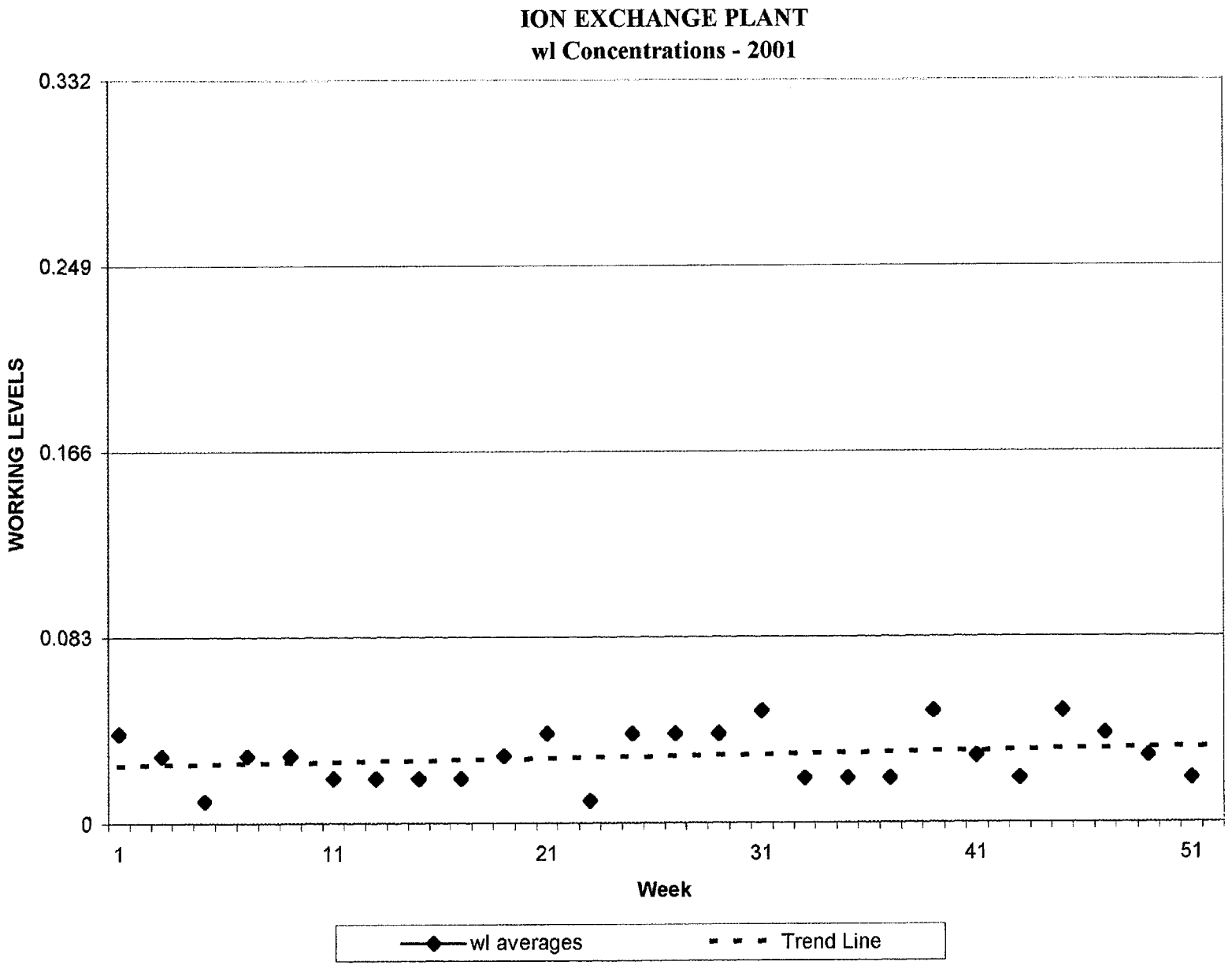
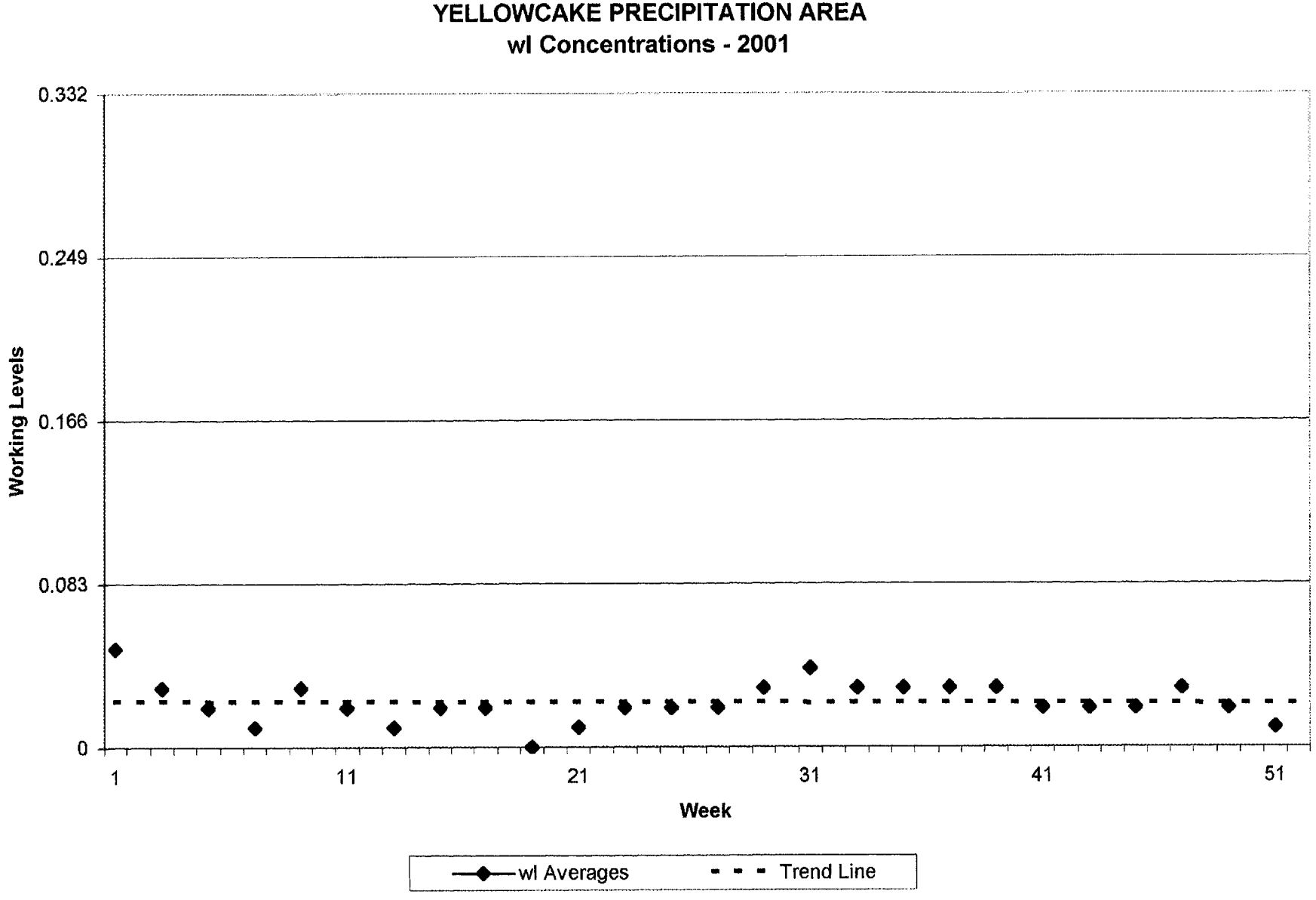
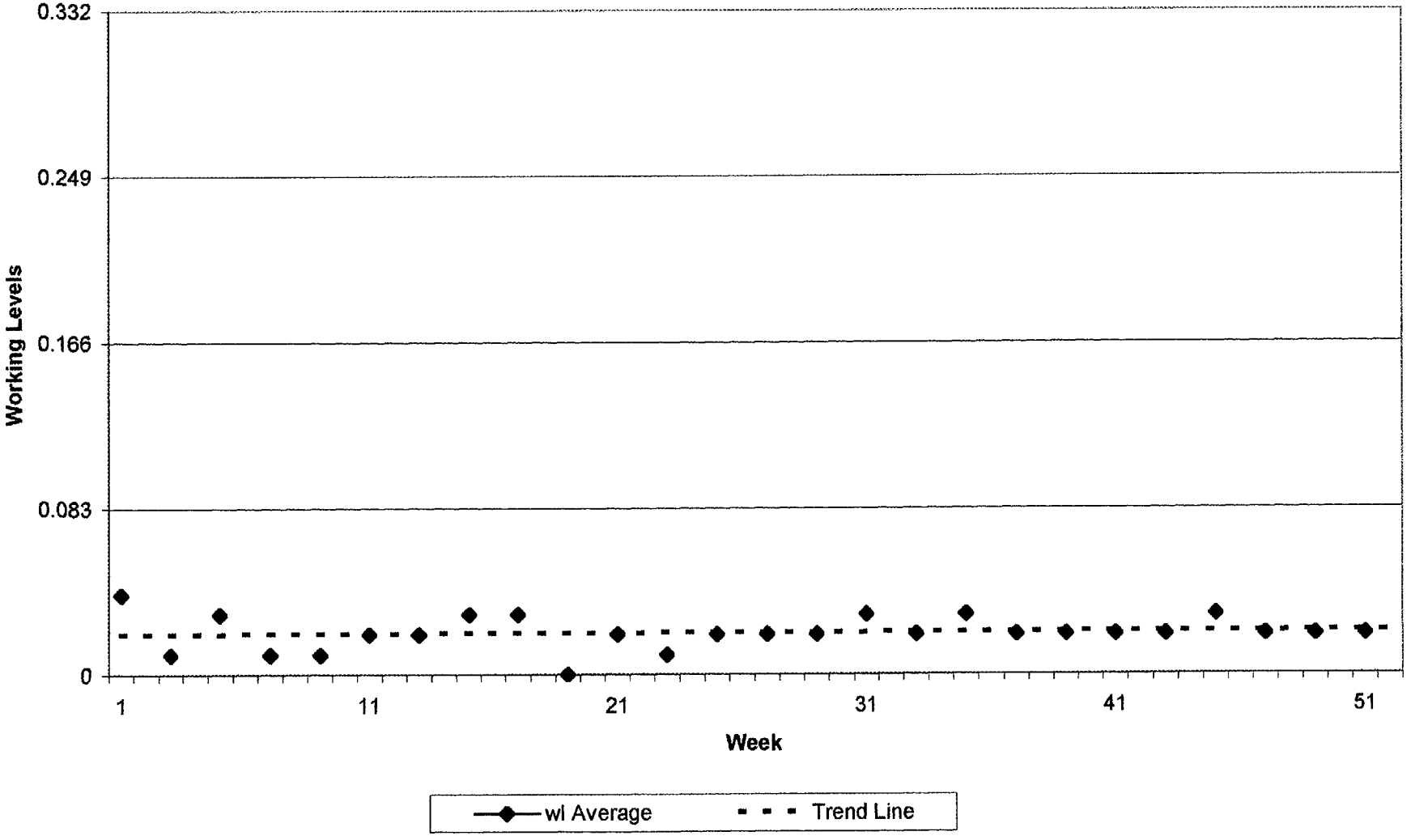
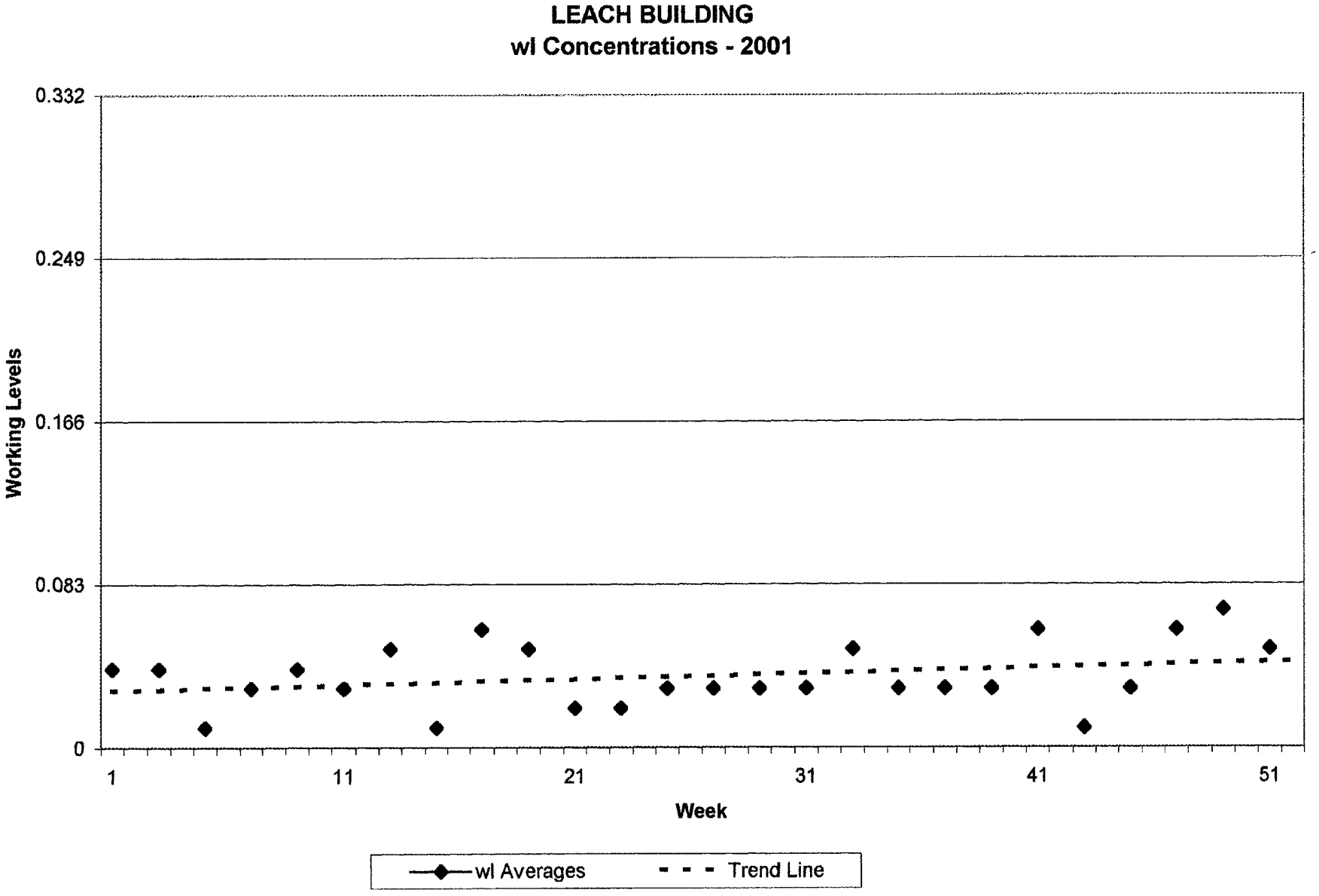
Exposure Trends


ION EXCHANGE PLANT
wl Concentrations - 2001
0.332
0.249
0.166
0.083
0
WORKING LEVELS
1
11
21
31
41
51
Week
wl averages
Trend Line

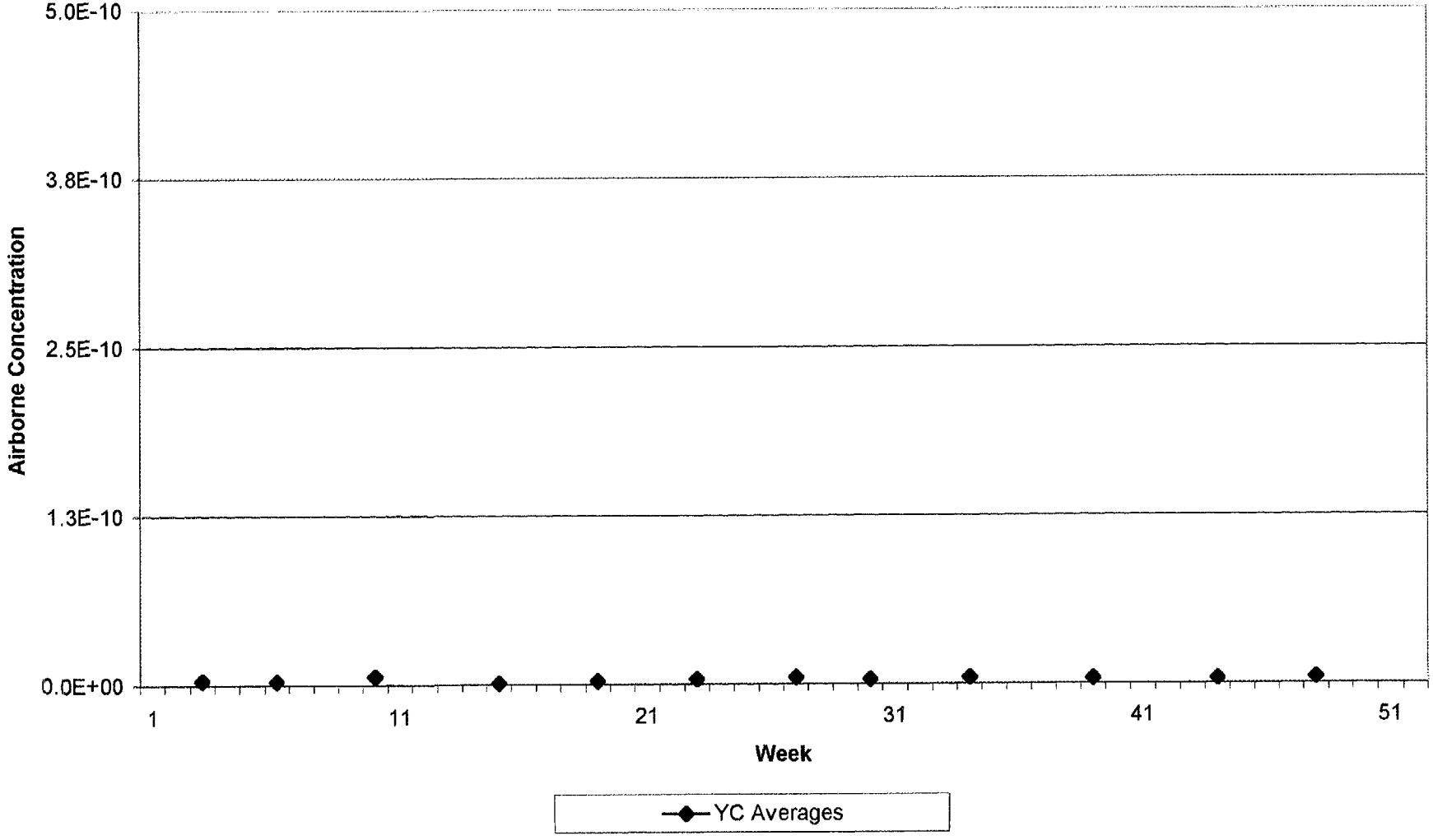

YELLOWCAKE PRECIPITATION AREA
wl Concentrations - 2001
0.332
0.249
0.166
0.083
0
Working Levels
1
11
21
31
41
51
Week
wl Averages
Trend Line

CHEMISTRY LABORATORY
wl Concentrations - 2001

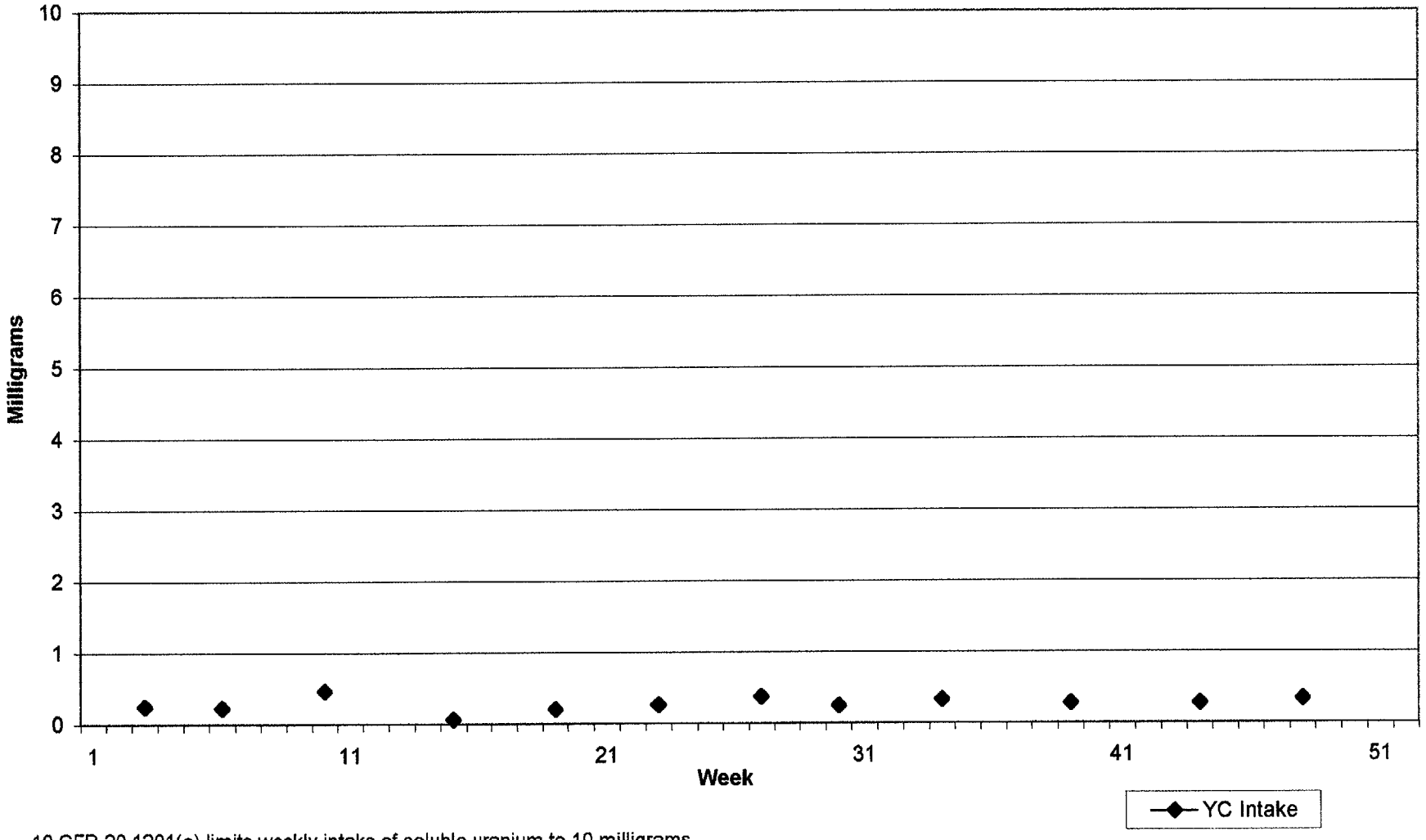



LEACH BUILDING
wl Concentrations - 2001
0.332
0.249
0.166
0.083
0
Working Levels
1
11
21
31
41
51
Week
wl Averages
Trend Line

YELLOWCAKE PRECIPITATION AREA
Airborne Yellowcake Concentrations - 2001



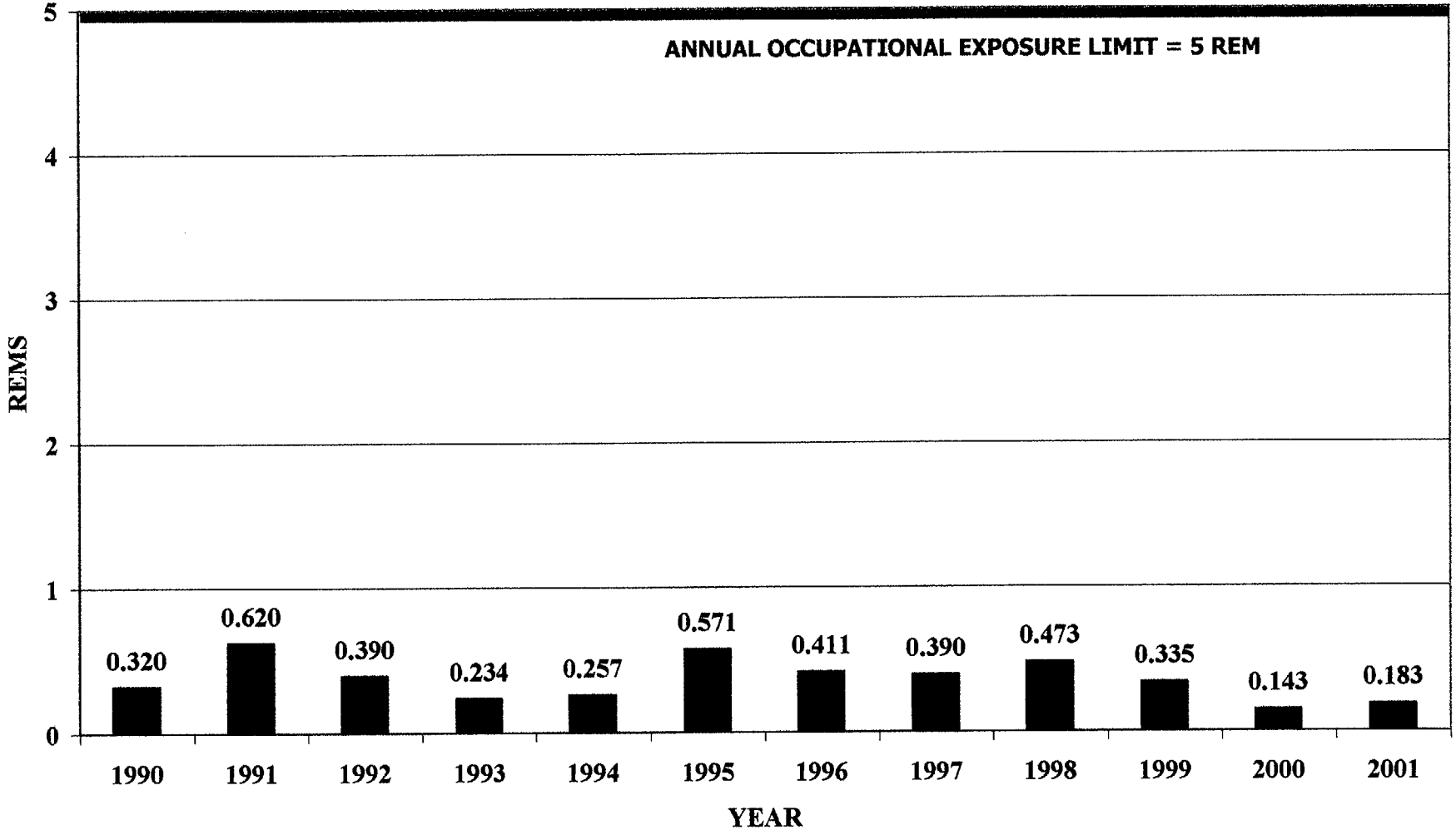
YELLOWCAKE PRECIPITATION AREA
Soluble Uranium Intake - 2001



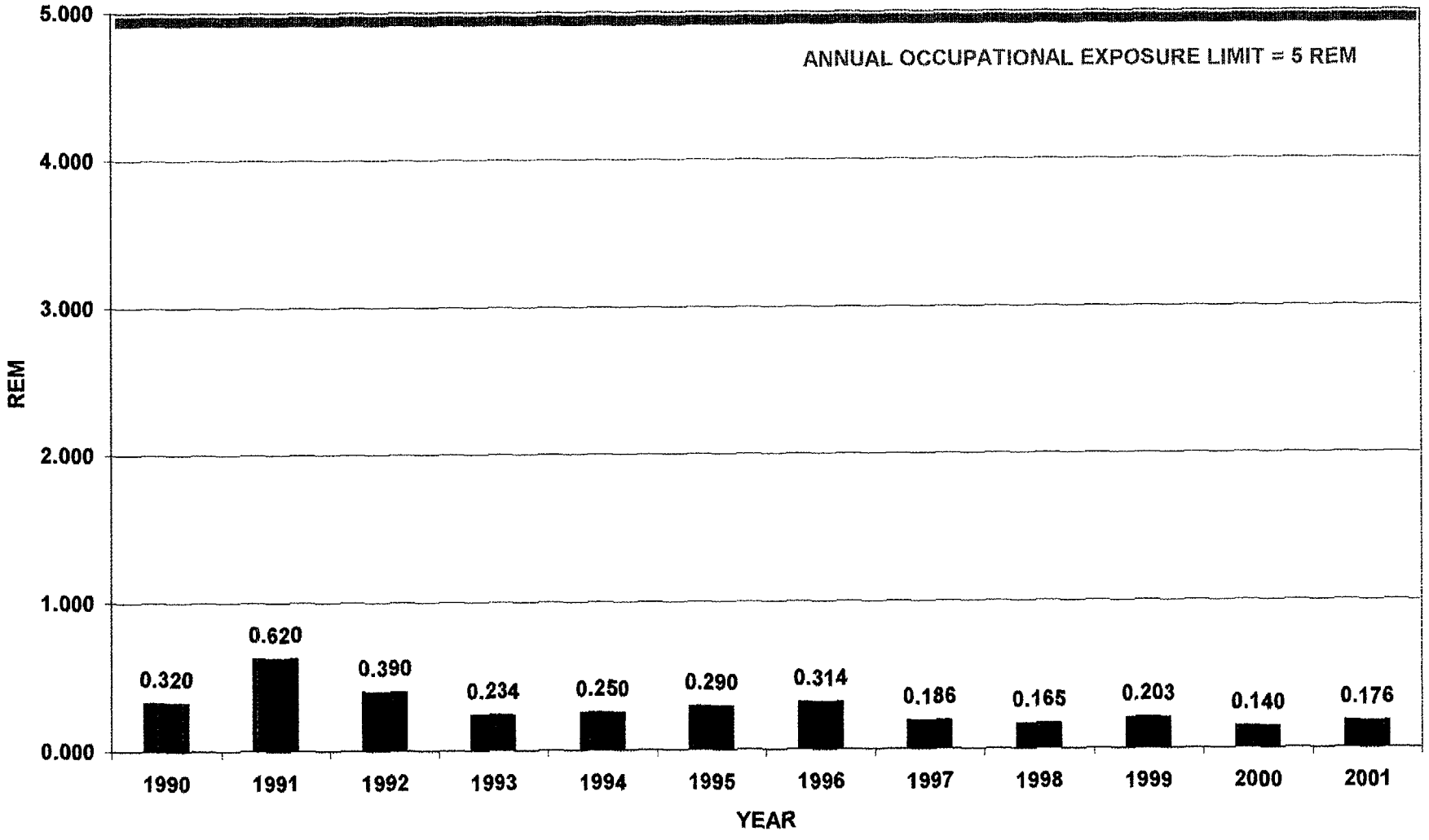
10 CFR 20.1201(e) limits weekly intake of soluble uranium to 10 milligrams.
Values based on continuous occupancy. Actual occupancy times are approximately half of continuous occupancy.

ANNUAL TEDE EXPOSURE

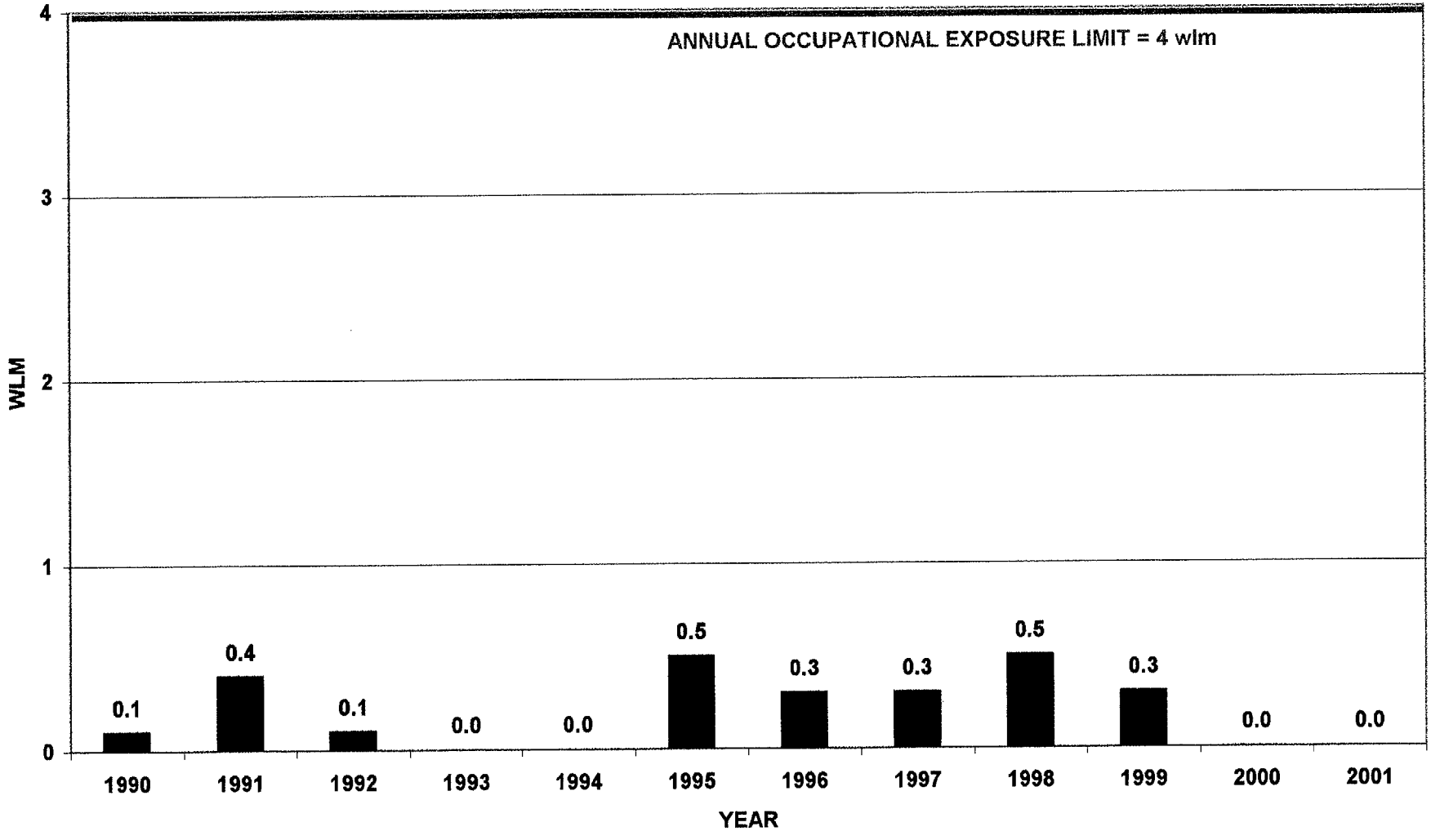
MAXIMUM EXPOSURE FOR ANY EMPLOYEE



ANNUAL EXTERNAL RADIATION EXPOSURE
MAXIMUM DEEP DOSE EXPOSURE LEVEL FOR ANY EMPLOYEE



RADON DAUGHTER EXPOSURES
MAXIMUM EXPOSURE FOR ANY EMPLOYEE



ANNUAL INTERNAL YELLOWCAKE DUST EXPOSURE LEVELS
MAXIMUM EXPOSURE FOR ANY EMPLOYEE