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### URINARY BIOMARKERS OF ATRAZINE EXPOSURE AMONG FARM PESTICIDE APPLICATORS

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**PURPOSE:** This study assessed the feasibility of three laboratory methods for the detection of atrazine, a triazine herbicide, and its related metabolites in urine collected from field applicators.

**METHODS:** Urine samples were collected from 256 randomly sampled field applicators 8 hours post application. Of these, 99 reported atrazine use during the application prior to sample collection and these samples were subsequently analyzed for urinary biomarkers.

**RESULTS:** 37.4% (n = 37) samples showed detectable levels (minimum = 1.0 ng/mL) of deethylatrazine using gas chromatographic mass spectrometry (GCMS) analysis (X = 14.2 ng/mL; s.d. = 13.5). Fifty samples were tested using atrazine mercapturate in urine ELISA methods and 80% (n = 40) of these samples showed detectable levels of atrazine (X = 6.4 ng/mL; s.d. = 7.5). Of 10 samples tested by triazines in water ELISA methods, a common assay used for the detection of atrazine in groundwater, 100% showed detectable levels of atrazine (X = 22.4 ng/mL; s.d. = 13.9). Of the 21 samples collected from non-applicators and tested by GCMS, none evidenced detectable atrazine levels. Using GCMS as the gold standard, analyses showed that the mercapturate in urine ELISA was 48% sensitive and 91% specific whereas the triazines in water ELISA was 69% sensitive and 100% specific.

**CONCLUSIONS:** It is possible to detect one-time atrazine exposures through analysis of urinary biomarkers among pesticide applicators. The feasibility of triazines in water ELISA methods for use in field studies for analyzing the presence of atrazine and related metabolites in urine was supported, but these methods need further testing on larger applicator samples before they can be used for standard screening.

PII S1047-2797(00)00150-2

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### MAGNETIC FIELD EXPOSURE OF COMMERCIAL AIRLINE PILOTS

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**PURPOSE:** Airline pilots are exposed to magnetic fields generated by the aircraft's electrical and electronic systems. The purpose of this study was to directly measure the flight deck magnetic fields to which commercial airline pilots are exposed when flying on different aircraft types over a 75-hour flight-duty month.

**METHODS:** Magnetic field measurements were taken using personal dosimeters capable of measuring magnetic fields in the 40-800 Hz frequency range. Dosimeters were carried by either the Captain or the First Officer on Boeing 737/200, Boeing 747/400,

Boeing 767/300ER, and Airbus 320 aircraft. The data were analyzed by aircraft type, with statistics based on block hours. Block hours begin when the aircraft departs the gate prior to take off and end when the aircraft returns to the gate after landing.

**RESULTS:** Approximately 1008 block hours were recorded at a sampling rate of 3 seconds. Total block time exposure to the pilots ranged from a harmonic geometric mean of 6.7 milliGauss (mG) for the Boeing 767/300ER to 12.7 mG for the Boeing 737/200.

**CONCLUSIONS:** Measured flight deck magnetic field levels were substantially above the 0.8 to 1 mG level typically found in the home or office and suggest the need for further study to evaluate potential health effects of long-term exposure.

PII S1047-2797(00)00131-9

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### NESTED CASE-CONTROL STUDY OF LEUKEMIA AMONG A COHORT OF PERSONS EXPOSED TO IONIZING RADIATION FROM NUCLEAR WEAPON TESTS IN KAZAKHSTAN (1949-1963)

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**PURPOSE:** A unique opportunity for epidemiological studies of cancer and other health effects of radiation exposures exists around the Semipalatinsk Nuclear Test Site in Kazakhstan. The present study is the first analysis of leukemia risk among the residents of downwind settlements exposed to radioactive fallout from atmospheric nuclear weapon tests (1949-1963) and followed up from 1960 to 1998.

**METHODS:** Within the cohort of 10,000 exposed subjects a case-control study was nested, including 22 leukaemia cases (except chronic lymphoid leukemia) and 132 controls individually (1:6 ratio) matched by birth year and sex. Leukemia deaths were identified by death certificates and diagnoses were verified by hospital records. The individual dose including internal and external exposure assessment was estimated according to the residency and age at exposure. All odds ratios were adjusted for ethnicity (Russian or Kazakh) as an independent variable.

**RESULTS:** The median dose of exposure for all subjects was 0.89 Sv ranging from 0.01 to 5.71 Sv. A nearly two-fold increased risk of leukemia was found (OR = 1.91; 95% CI = 0.38 to 9.67) for persons exposed to doses of >2.0 Sv as compared to those exposed to <0.5 Sv, but no increase in risk with the dose was found for those exposed to doses lower than 2 Sv. Detailed evaluation of dose-response showed an excess relative risk for leukemia of 10% per 1 Sv of additional exposure.

**CONCLUSIONS:** Our findings suggest that there is an increased risk of leukemia among those exposed to >2 SV as compared to those exposed to <0.5 Sv, but this could have been a chance finding due to the small number of cases and low statistical power.

PII S1047-2797(00)00136-8