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WHITE PHOSPHORUS ABSORPTION IN DUCKS: RATE, EXTENT, AND COMPLETENESS OF ABSORPTION OF PARTICLES IN RELATION TO DEVELOPMENT OF TOXICITY

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Extensive measurements of white phosphorus (P_4) in the gizzards of poisoned birds collected from Eagle River Flats (ERF) have been made. The birds did not die as a result of the P_4 found in the gizzard since it was not yet absorbed, and it is unlikely that the gizzard is the major site of P_4 absorption. It is not known where in the gastrointestinal tract and at what rate P_4 is absorbed. It is even possible that some P_4 particles could be dissolved and absorbed prior to entry into the gizzard. The physical behavior of solid P_4 is unique. At temperatures at ERF, P_4 is a soft waxy solid; however at 34.4°C , P_4 becomes brittle. The body temperature of birds is approximately 40°C . Ingested sediments are relatively cool, but warm to above the temperature at which P_4 becomes brittle. Some gizzards contain grit to grind seeds and likely reduce the size of the P_4 particles. Bird species that ingest P_4 , but do not reduce it by grinding action might not be susceptible to P_4 since P_4 might not readily be dissolved from particles.

We wish to determine the location of P_4 absorption and the factors controlling its dissolution from particles. Similar work has been done to understand lead shot and its toxicity.

SPECIFIC TASKS**SITE OF ABSORPTION AND RATE OF ABSORPTION OF P_4 FROM PARTICLES**

P_4 particles will be made with traces of fluorescent dyes. Ducks will be dosed with particles, and sacrificed at the first signs of convulsions. The gastrointestinal tract will be isolated and the distribution of fluorescent particles and the particle size will be determined microscopically. Regional concentrations will be determined chemically.

RELATIONSHIP OF TOXICITY TO RATES OF ABSORPTION AND TISSUE ACCUMULATION

In ducks, we will relate the signs of neurotoxicity (lethargy, response to startle, muscular incoordination, muscular weakness, tremors, and convulsions) to the extent of P_4 absorption. Absorption will be measured by the disappearance of P_4 from the gastrointestinal tract and its appearance in tissues. These signs of toxicity are important in that they are all adverse to survival by directly contributing to prey attraction or lack of avoidance and/or entanglement with vegetation.

CONFIRMATION OF LABORATORY FINDING WITH FIELD OBSERVATIONS

Ducks and swans poisoned by P_4 will be collected and time to development of toxic signs will be determined if possible. Absorption from regions of the gastrointestinal tract and accumulation in tissues will be assessed.

PAY-OFF

The physical properties of P_4 particles and their reduction and dissolution in the gastrointestinal tract may be important in determining which species are at risk and which individuals are susceptible. The persistence of P_4 in digestive tracts poses a risk to predators.