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<b>Project</b>				
Brine RESRAD results				
<b>Subject</b>				
RESRAD Dose Assessment of Brine				

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RESRAD Dose Assessment of Commercially Produced Brine				

### **EXECUTIVE SUMMARY**


The Ohio Department of Health (ODH) was asked to conduct RESRAD modeling of brine samples.

The modeling was performed using Radium-226 and Radium-228.

The annual radiological dose modeling result per application was 0.6 millirem per year (mrem/yr) for an adult and 0.61 mrem/year for a child. To obtain dose for multiple applications, multiply the number of applications by the dose for a single application (0.6 and 0.61 mrem).

For comparative purposes, the average background radiation dose received by a member of the public is approximately 620 mrem/yr. The annual regulatory limit for radiation dose received by a member of the public by licensed uses of radioactive material is 100 mrem/yr. The annual regulatory limit for radiation dose received by a trained radiation worker at a licensed facility is 5000 mrem/yr.

Based upon the data provided there is negligible radiological health and safety risk.

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RESRAD Dose Assessment of Commercially Produced Brine				

## 1. BACKGROUND

The Ohio Department of Health (ODH) was asked to conduct RESRAD modeling on brine product samples containing Radium-226 and Radium-228

RESRAD is a computer code developed by Argonne National Laboratory, was used to determine if doses “to an average member of the critical group” from residual radioactive materials are a health risk.

The highest concentrations were:

- 1158 **picoCuries per liter** (0.965 **picoCuries per gram**) Radium-226; and
- 1333 **picoCuries per liter** (1.111 **picoCuries per gram**) of Radium-226.

## 2. MODEL SCENARIO

The brine is applied over a 1000 square foot area with an occupancy time of 2 hours per day, seven days a week, 365 days per year. The time is spent entirely outside.

## 3. ADDITIONAL ASSUMPTIONS USED FOR THE RESRAD RUN


The following assumptions were also made when using the computer model:

- The maximum measured concentrations of Radium-226 and Radium-228 were converted to picoCuries/gram
- There is no irrigation
- The material was applied one time over a 1000 square foot area
- The material saturates the soil 2 inches deep.
- All exposure pathways are considered
- RESRAD defaults were used for all parameters except precipitation, contaminated zone hydraulic conductivity, total and effective porosity, and irrigation coefficient.
- For children, soil ingestion rates, inhalation rates, and ingestion rates were USEPA values used for children.

The parameters used are included in the RESRAD output in Appendix B and C. Appendix B contains the output for adults and Appendix C includes the output for children.

## 4. RESULTS

The results in graphical form are shown in Appendix A. The maximum calculated dose for an adult was 0.6 mrem/year at time zero. The maximum calculated dose rate for children was 0.61 mrem/year at time zero.

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To determine the dose for a conservative estimate of twelve applications over the winter season, multiply the maximum dose for one application by twelve. This yields a dose of 7.2 mrem/year.

	Radiation dose
Radiation dose from evaluated brine application.	7.2 mrem/yr
Average background radiation dose received by a member of the public.	620 mrem/yr
Regulatory limit for radiation dose received by a member of the public by licensed uses of radioactive material.	100 mrem/yr
Annual regulatory limit for radiation dose received by a trained radiation worker.	5000 mrem/yr

## 5. CONCLUSIONS

Application of this material poses a negligible radiological health risk to public health and safety. The results of these models are conservative.