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Radium Dial Watches

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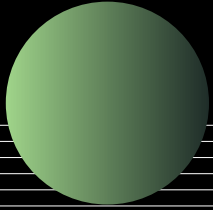
RADIUM DIAL WATCHES



(Connor & Connor 2017)



Are Radium
Dial Watches
Hazardous?

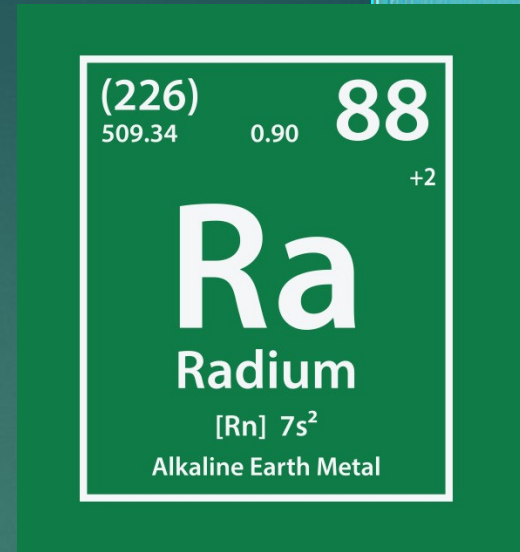


Outline

- Facts About Radium
- History
- Uses
- Radioluminescent paint
- Material used for experiment
- Procedure
- Results
- Emissions
- Radium and Bone Destruction
- Conclusion
- References

Facts About Radium

- ▶ Alkaline metal (Ross 2016)
- ▶ Atomic number=88 (Ross 2016)
- ▶ Common Isotopes: Ra-226 and Ra-228(Ross 2016)
- ▶ Electron Configuration: $1s^2 2s^2 2p^6 3s^2 3p^6 3d^{10} 4s^2 4p^6 4d^{10} 5s^2 5p^6 4f^{14} 5d^{10} 6s^2 6p^6 7s^2$ (Straka)
- ▶ Extremely radioactive (Ross 2016)
- ▶ Very reactive and can emit radiations that potentially cause health concerns which can, after immense exposure, ultimately leads to death. ("It's Elemental")



(Cerebrands 2017)

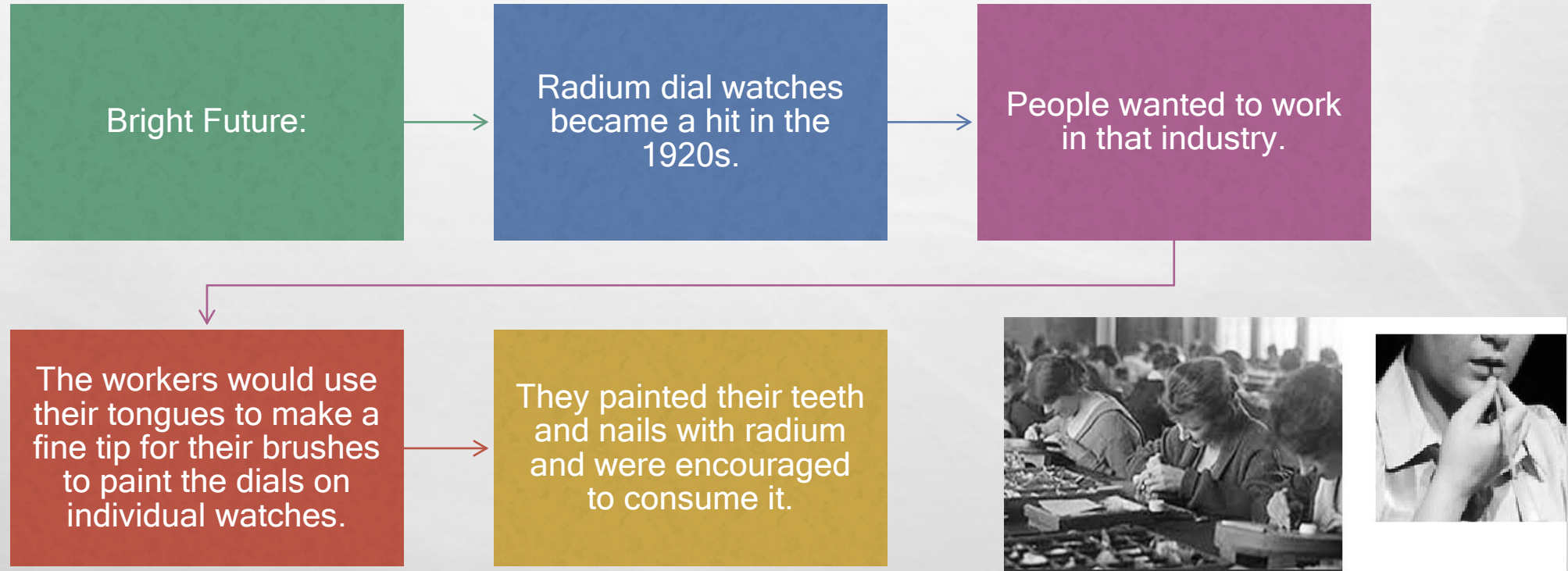


(Jackson)



(Jackson)

HISTORY OF RADIUM DIAL WATCHES



(HISKEY "GLOWING IN THE DARK, THE "RADIUM GIRLS"" 2014)

("Radium_Paint_Factory_Workers_Mouth")

HISTORY CONT.:

Unexplainable Outcomes:

The painters developed necrosis on the maxilla and mandible (jaw bones)
(Gillmore et al, 92)

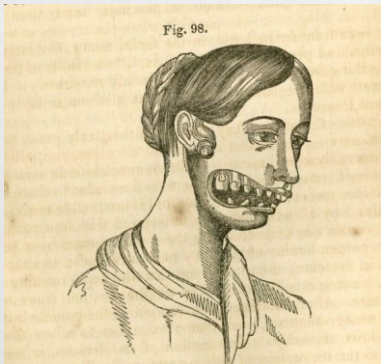
They realized that their teeth were decaying.

The skin around their mouths were starting to open up holes. In 1922, Cecil Drinker, a Harvard physiologist, later discovered this was due to the radium they consumed.

What was in the radium that caused such a dreadful outcome?



(Moore 2017)

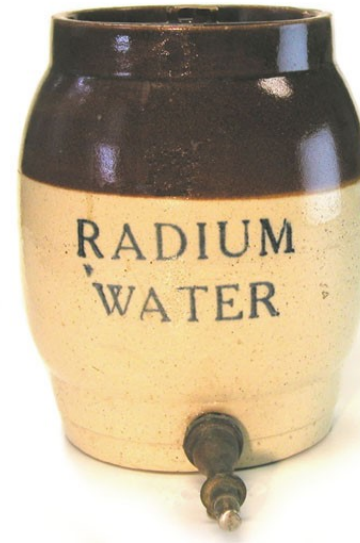


(Hunter)

(HISKEY "GLOWING IN THE DARK, THE "RADIUM GIRLS""
2014)

Radium was used in:

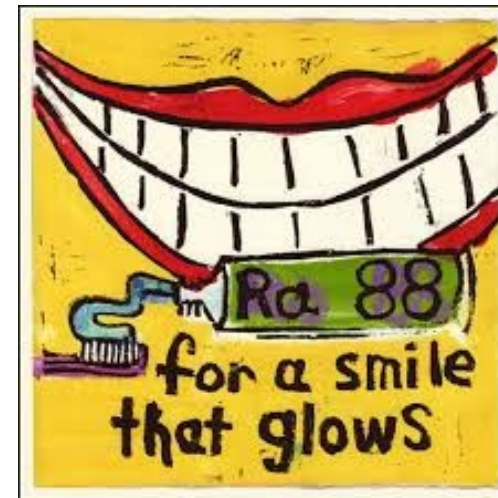
- Water
- Creams
- Toothpaste
- Certain medicines



(Jacques)



(vintage_ads & write_light 2014)

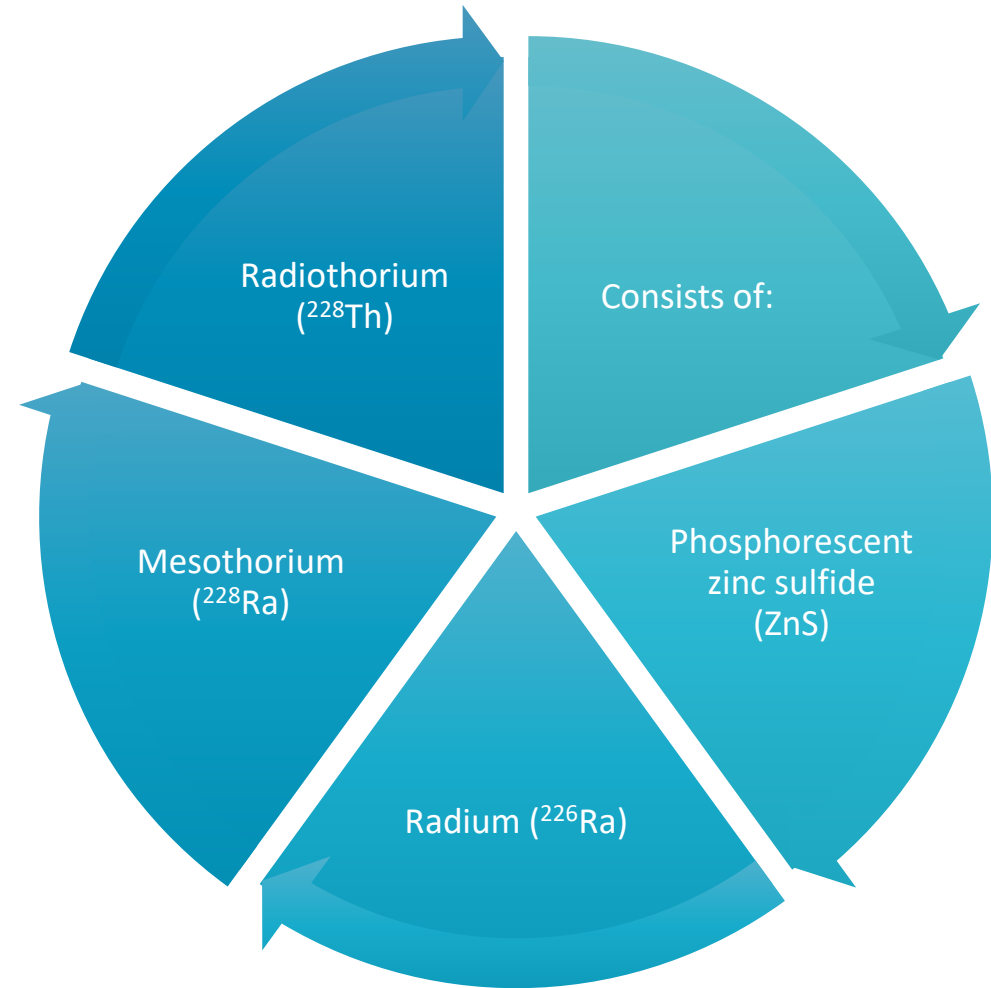


("Radioactivity")



(Grove)

Radioluminescent Paint



(Gillmore et al, 91)

MATERIALS USED FOR EXPERIMENT

Materials	Quantity
Pocket watches (1930s-1950s) (Gillmore et al, 94-95)	15
Wristwatches (1950s-1960s) (Gillmore et al, 94-95)	18
World war I compass (Gillmore et al, 94-95)	1
A phantom (Gillmore et al, 94-95) (objects used to mimic the human tissues to test how certain radiations affect the body) (Bouchard, et al. 2010)	-
A body thermoluminescence dosimeter(Gillmore et al, 94-95)	-
Mini-Rad 1000 (to measure gamma dose rates) (Gillmore et al, 94-95)	-
An alpha/gamma spectrometer(Gillmore et al, 94-95)	-
A C39 detector (to assess the leakage of radium gas) (Gillmore et al, 94-95)	-

PROCEDURE

Step 1

- The Mini-Rad 1000 was used to determine the gamma radiation dose each watch emitted.

Step 2

- The alpha and gamma spectrometry was performed to determine the composition of ^{226}Ra in the watch.

Step 3

- A phantom was used to calculate the amount of radiation bodies were exposed to by the radium dial watches.

Step 4

- A C39 detector was used to find out how much radon gas was leaking from the dial watches.

RESULTS

The front side of the watch released a higher dose of radiation than the back side.

4 alpha emissions were confirmed (^{226}Ra , ^{222}Rn , ^{218}Po and ^{238}U)

The gamma spectrometer confirmed the presence of ^{226}Ra . When it decays it emits alpha beta and gamma radiations.

<i>Particle</i>	<i>Symbol</i>	<i>Mass</i>	<i>Penetrating Power</i>	<i>Ionizing Power</i>	<i>Shielding</i>
<i>Alpha</i>	α	4 amu	Very Low	Very High	Paper Skin
<i>Beta</i>	β	1/2000 amu	Intermediate	Intermediate	Aluminum
<i>Gamma</i>	γ	0 (energy only)	Very High	Very Low	2 inches lead

Radiations: Alpha Beta and Gamma Emissions

Radium and Bone Destruction

Body is exposed to radium through breathing drinking or touching (" RADIUM - 226 AND 228" 2015)

This allows the radium to flow throughout the body(" RADIUM - 226 AND 228" 2015)



("The Radium Girls: How an entire workforce was killed by radiation poisoning - How It Works" 2017)

Anemia, Jaw Necrosis, Sarcoma ("The Radium Girls: How an entire workforce was killed by radiation poisoning - How It Works" 2017)

Radium is left in the body for a very long time(" RADIUM - 226 AND 228" 2015)



("The Radium Girls: How an entire workforce was killed by radiation poisoning - How It Works" 2017)

The bones are mostly affected because radium decreases the red blood cell count ("The Radium Girls: How an entire workforce was killed by radiation poisoning - How It Works" 2017)

CONCLUSION

This experiment was held in 2012 to understand the components of the dial watches that make them very dangerous. They found multiple alpha, beta and gamma emissions. Beta emissions can be avoided with a t-shirt or some form of clothing that would block the emission. For gamma emissions, they can penetrate the skin very easily and can cause many complications. (Gilmore et al, 91-98)

Radium is highly reactive. It was believed that radium emitted a healthy type of radiation that would strengthen the body and protect it from cancers. People believed it acted the same way calcium does towards our bones. It was later on discovered that unlike calcium, radium destroys and breaks down the bones. (Hiskey)

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