

# SPARK SQUAD

A STORY FROM THE NATIONAL RENEWABLE ENERGY LABORATORY

## VOLUME 3



The NREL logo features a stylized sun icon to the left of the letters "NREL".

**NREL**

U.S. Department of

**ENERGY**

Office of Nuclear Energy

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**NATIONAL RENEWABLE ENERGY LABORATORY (NREL)  
15013 DENVER WEST PARKWAY | GOLDEN, CO 80401**

# A BRIEF INTRODUCTION TO ENERGY



HI! I'M POWER OFFICER GINA AND I'M HERE TO TALK ABOUT ENERGY!



WE USE ENERGY TO POWER ALMOST EVERYTHING IN OUR LIVES!



ENERGY COMES FROM ALL DIFFERENT KINDS OF PLACES.



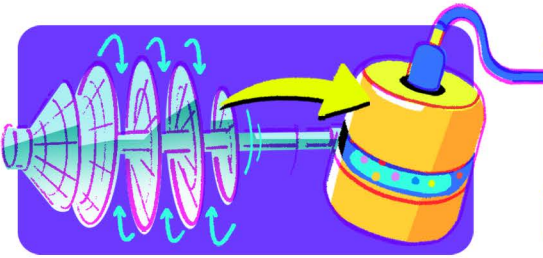
POWER OFFICERS AND ENERGIZERS USE SPECIAL GOGGLES TO SEE ENERGY AS...



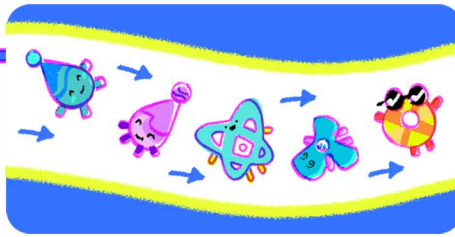
## JOULES!



THE JOULES ARE PLAYFUL AND FULL OF ENERGY! WE USUALLY FIND THEM ENJOYING VARIOUS OUTDOOR ACTIVITIES.



USING GENERATORS SUCH AS TURBINES, WE CAN USE THE JOULES FOR ELECTRICITY OR CAPTURE THEM AND STORE THEIR ENERGY TO USE LATER!



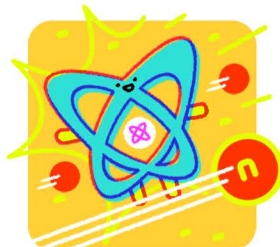
WHEN WE'RE READY TO USE THE ENERGY FROM THE JOULES, THEY TRAVEL THROUGH WIRES...



AND USE THEIR ENERGY AND EXCITEMENT TO POWER OUR DEVICES!



ONCE A JOULE HAS BEEN USED TO POWER SOMETHING, IT GETS REALLY TIRED...



BUT AFTER A REST, THE JOULE RETURNS TO DOING WHAT IT LOVES TO DO!

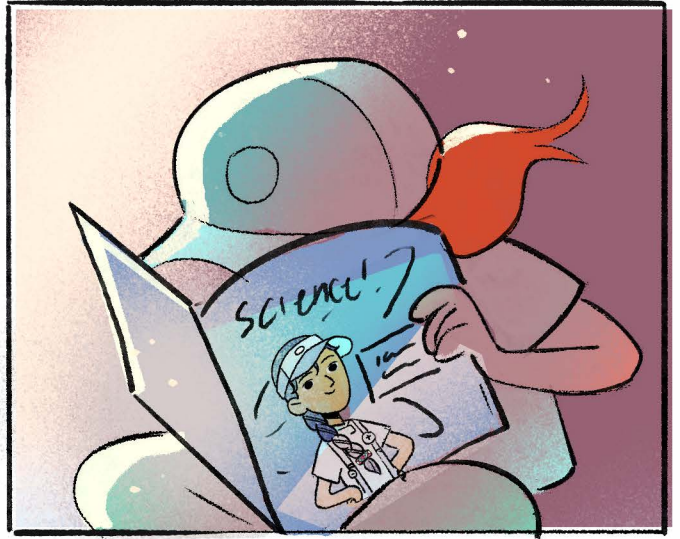


THEN THE WHOLE PROCESS CAN START AGAIN!



IF YOU THINK YOU WOULD LIKE TO LEARN MORE ABOUT ENERGY AND JOULES, CONSIDER BECOMING AN ENERGIZER!

ONE FALL AFTERNOON...



HEY! WE GOT A LETTER FROM SPARK SQUAD HQ!



CONGRATULATIONS!

OUR COMMITTEE HAS  
YOUR PROPOSED INVENTIONS  
LIKE TO FORMALLY INVITE

CONGRATULATIONS! OUR  
COMMITTEE HAS REVIEWED YOUR  
PROPOSED INVENTIONS AND  
WOULD LIKE TO ...

... FORMALLY INVITE  
YOU TO COMPETE IN THE  
REGIONAL QUALIFYING COMPETITION  
FOR THE POWER FAIR!



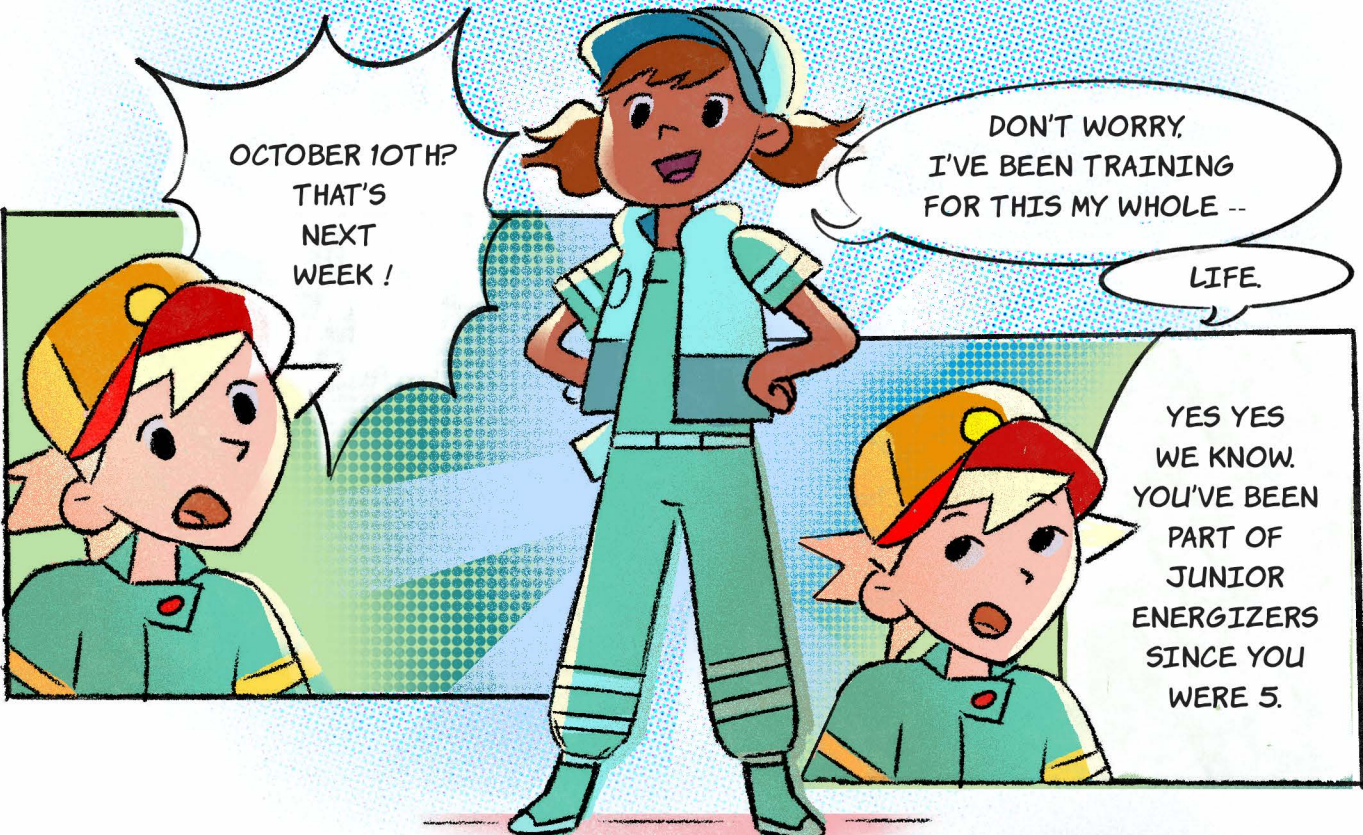
YAY! WE'RE GOING  
TO REGIONALS!



WAIT IT SAYS  
SOMETHING ELSE ...



"IN ORDER TO COMPETE IN REGIONALS, YOU MUST FIRST COMPLETE A CHALLENGE: ALL COMPETITORS MUST COLLECT 1 KILOWATT OF JOULES BY OCTOBER 10TH!"

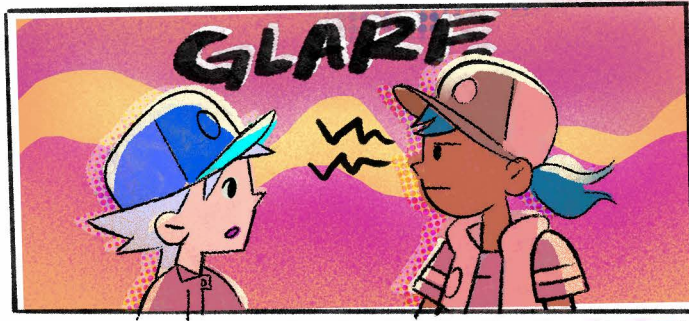


OCTOBER 10TH?  
THAT'S  
NEXT  
WEEK!

DON'T WORRY,  
I'VE BEEN TRAINING  
FOR THIS MY WHOLE --

LIFE.

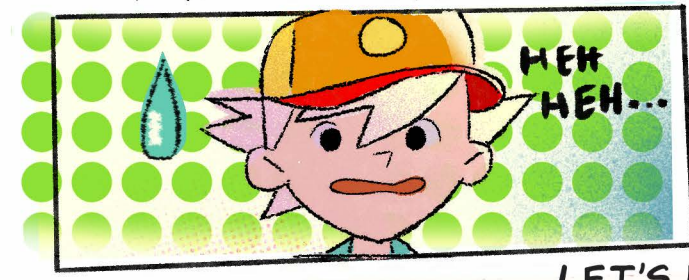
YES YES  
WE KNOW.  
YOU'VE BEEN  
PART OF  
JUNIOR  
ENERGIZERS  
SINCE YOU  
WERE 5.



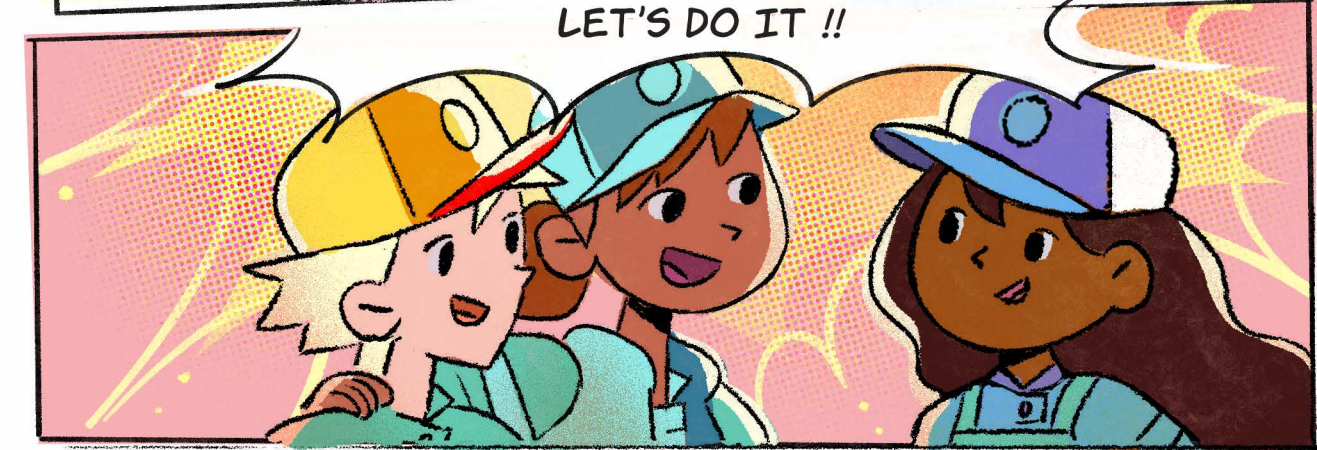
**GLARE**



IF WE WORK  
TOGETHER,  
WE SHOULD  
BE ABLE  
TO COLLECT  
1 KILOWATT  
OF JOULES  
NO PROB.



HEH  
HEH...



LET'S DO IT !!





**DRUMROLL...**



KEEP GOING,  
STILL A LONG  
WAY TO GO!

OKAY WE'VE BEEN  
AT THIS ALL WEEK AND  
I'M ONLY 10% TO  
1 KILOWATT.  
WHAT ABOUT YOU  
TWO?

I GOT UP TO  
50%. BUT NOW  
IT'S 8%...



I THINK WE'RE GOING TO NEED  
MORE POWERFUL JOULES.

I WAS  
TALKING TO  
SOMEONE THE  
OTHER DAY AND  
THEY SAID THAT  
NUCLEAR JOULES  
ARE LIKE WAY  
MORE POWERFUL  
THAN ANY  
OTHER.

REALLY?





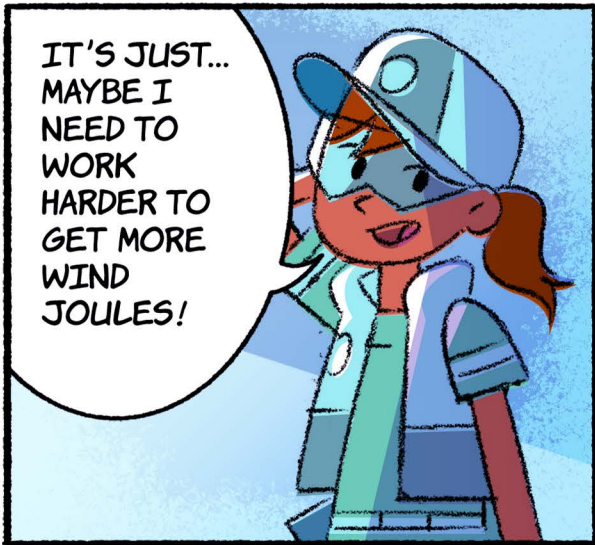


YEAH, I HEARD IT'S ONE OF THE SAFEST FORMS OF ENERGY OUT THERE!

HOW COOL!

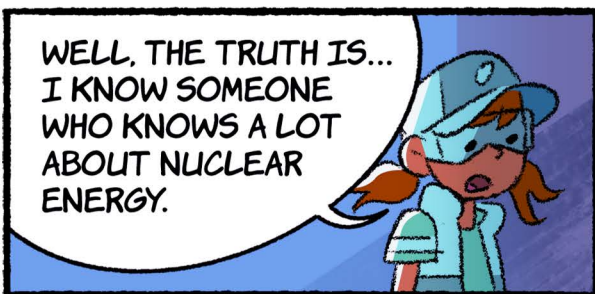
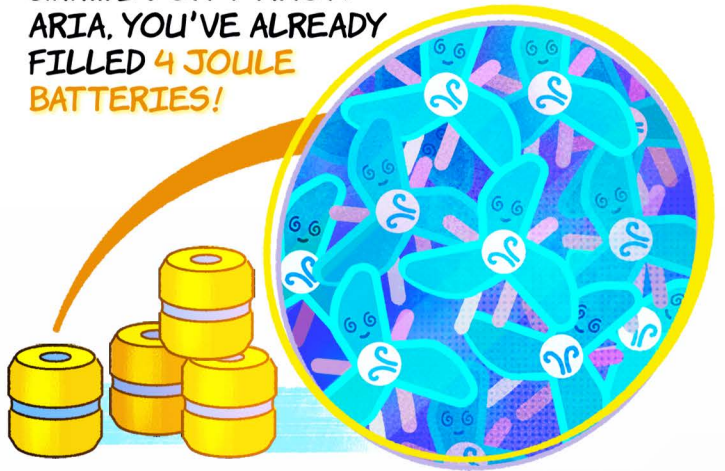


WHAT'S WRONG ARIA?



IT'S JUST... MAYBE I NEED TO WORK HARDER TO GET MORE WIND JOULES!

UHH... I DON'T KNOW ARIA, YOU'VE ALREADY FILLED 4 JOULE BATTERIES!



WELL, THE TRUTH IS... I KNOW SOMEONE WHO KNOWS A LOT ABOUT NUCLEAR ENERGY.



**YOU KNOW DAKOTA!?!**

WASN'T SHE THE JUNIOR ENERGIZER'S INNOVATOR OF THE YEAR??



WELL... I DID...



I JUST HAVEN'T TALKED  
TO HER IN A WHILE ...

AND NOW SHE'S  
SUPER FAMOUS.

SO I'M NOT SURE SHE REMEMBERS  
WHO I AM.

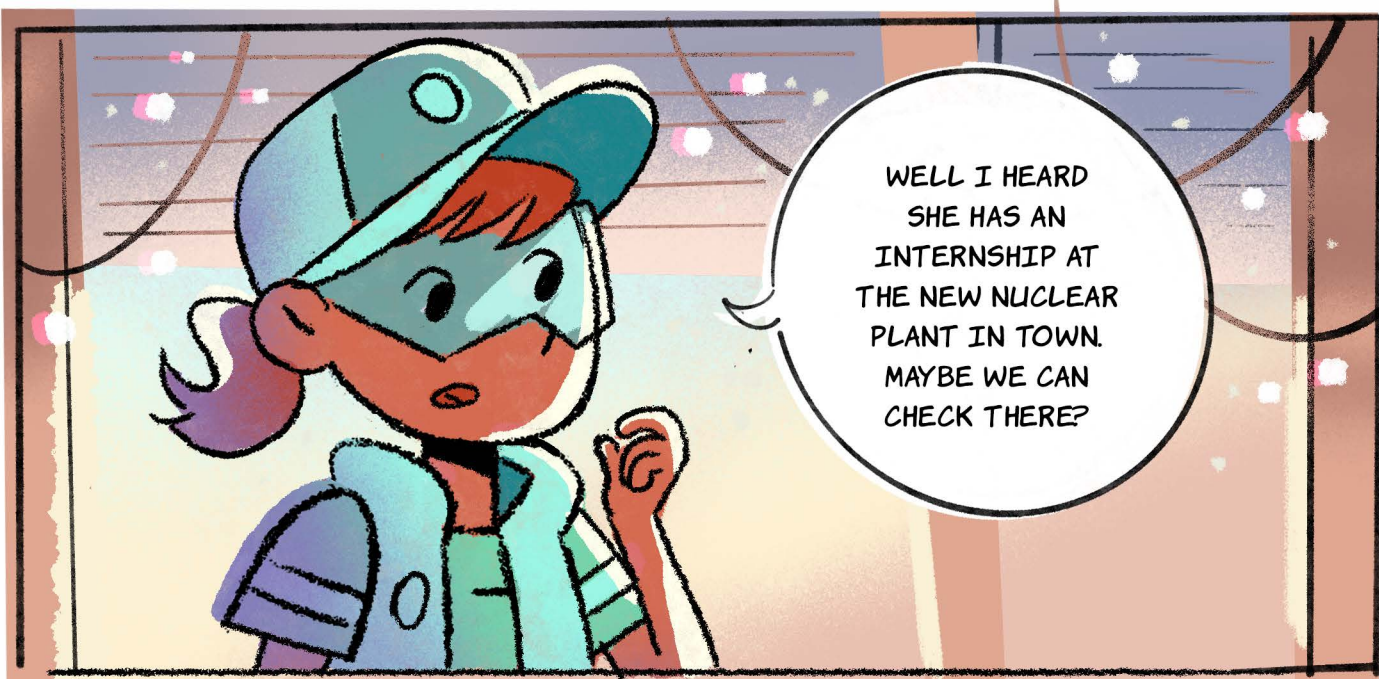


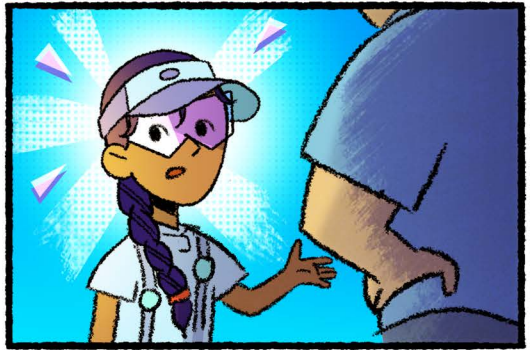
AW ARIA I'M SURE  
SHE DOES ! EVEN MORE OF  
A REASON TO MEET UP  
WITH HER !

WE'RE  
ALSO  
RUNNING  
OUT OF  
TIME ...



WELL I HEARD  
SHE HAS AN  
INTERNSHIP AT  
THE NEW NUCLEAR  
PLANT IN TOWN.  
MAYBE WE CAN  
CHECK THERE?





OH MY GOSH, ARIA!  
IT'S BEEN SO LONG!

THIS IS JASMINE  
AND THOMAS.

WAIT AREN'T  
YOU ALL PART  
OF THE SPARK  
SQUAD?!!

I NEED TO  
SHOW YOU  
SOMETHING.

RUSTLE  
RUSTLE

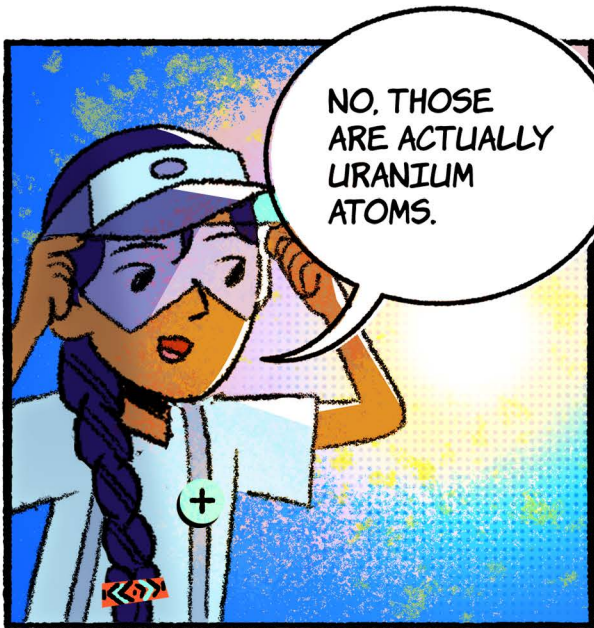
SHE KNOWS  
US...?

I MODIFIED A CLOUD  
CHAMBER AND SOME OF  
THE GADGETS SPARK SQUAD  
GAVE US.

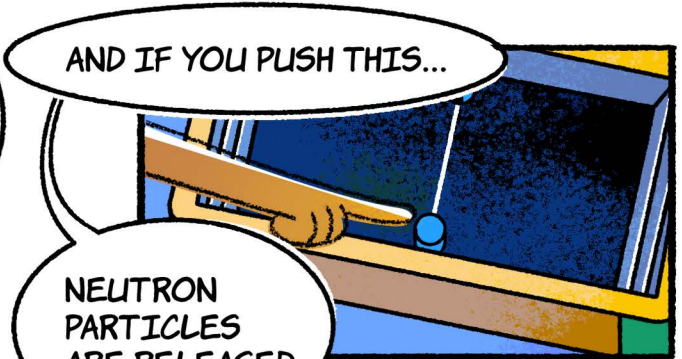
IT'S SUPPOSED TO  
HELP GENERATE  
AND CAPTURE NUCLEAR  
JOULES.

WAIT...  
ARE  
THESE  
JOULES?

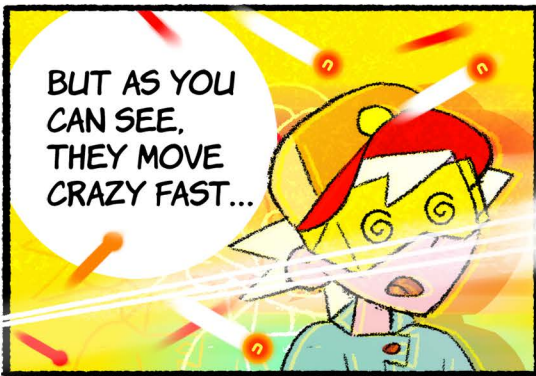
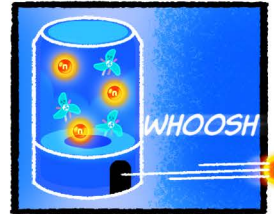
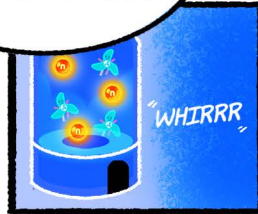




NO, THOSE ARE ACTUALLY URANIUM ATOMS.



AND IF YOU PUSH THIS...  
NEUTRON PARTICLES ARE RELEASEED.



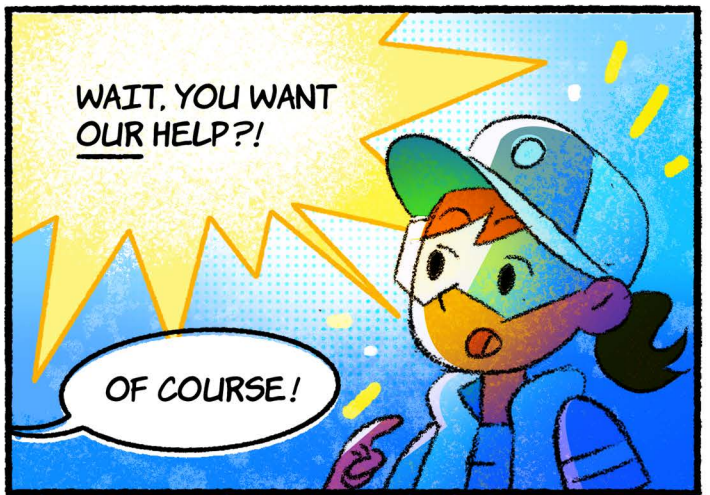
BUT AS YOU CAN SEE, THEY MOVE CRAZY FAST...



AND THE U-235 ATOMS JUST SIT THERE!

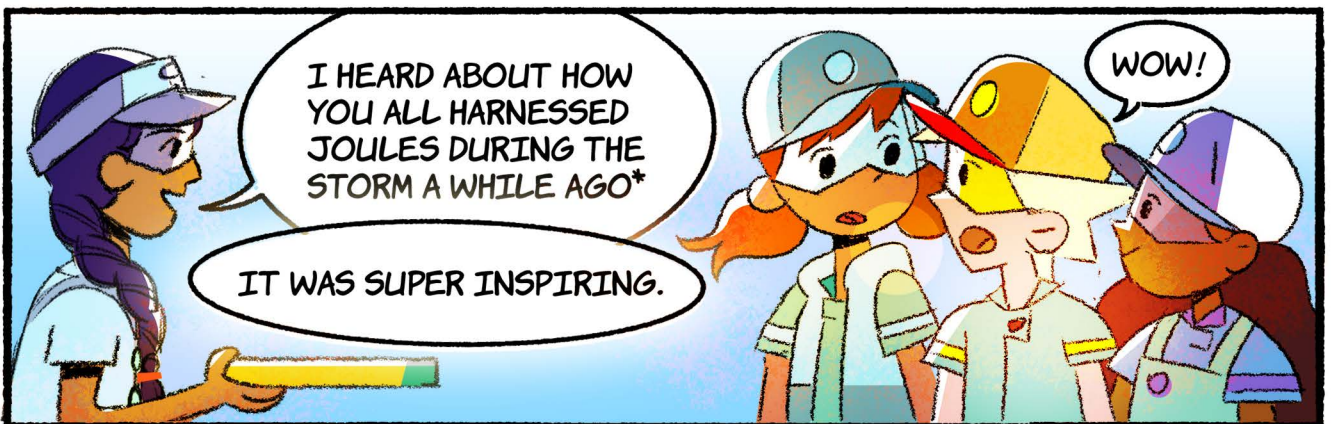


DO YOU THINK YOU CAN HELP?



WAIT, YOU WANT OUR HELP?!

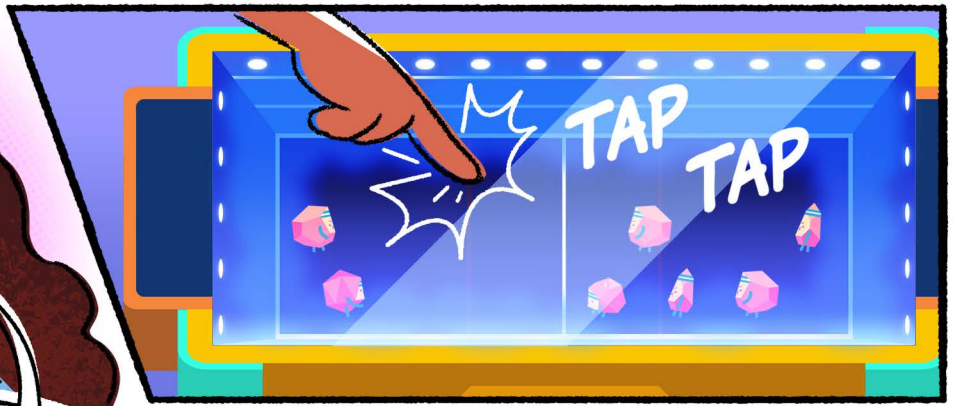
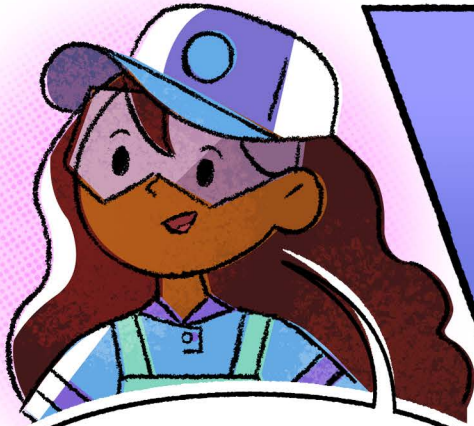
OF COURSE!



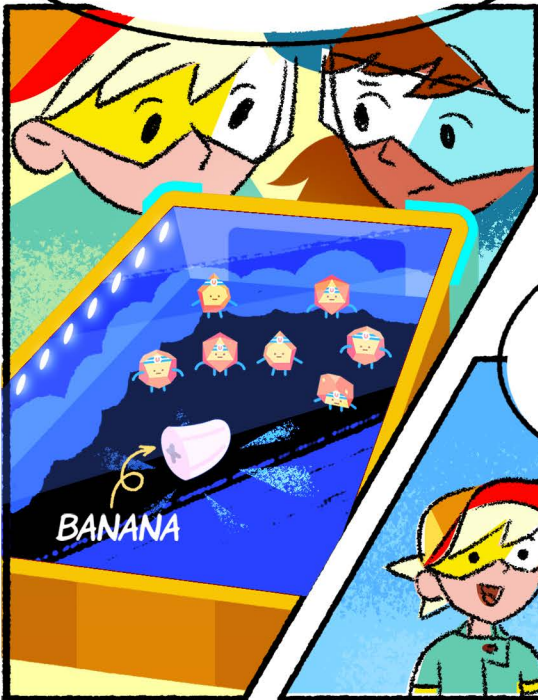
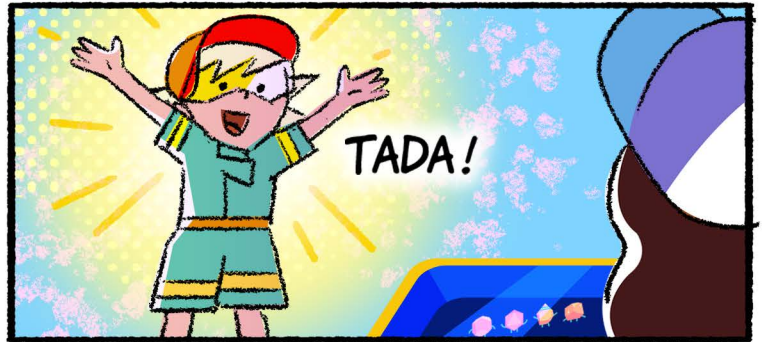
I HEARD ABOUT HOW YOU ALL HARNESSSED JOULES DURING THE STORM A WHILE AGO\*

IT WAS SUPER INSPIRING.

WOW!

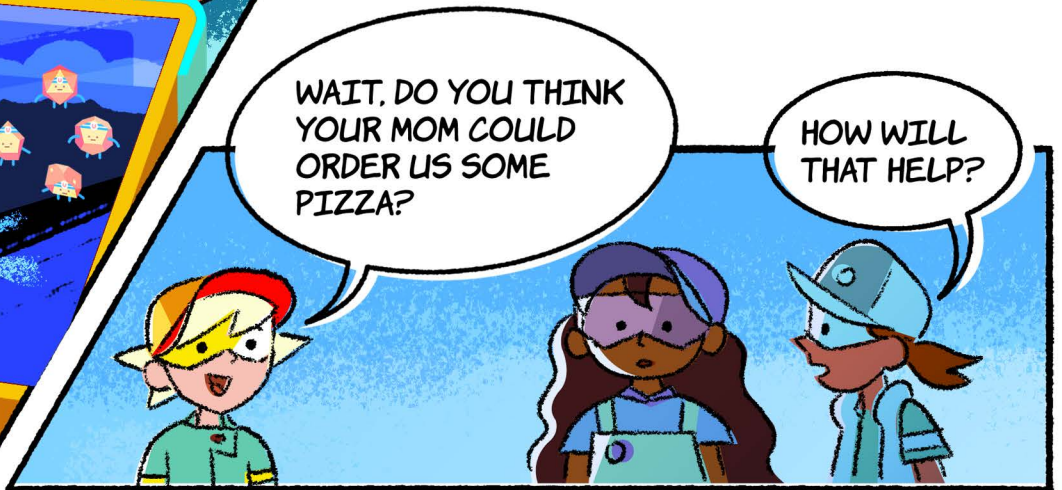


OKAY! WE CAN TRY AND HELP GET THE U-235'S EXCITED!



WAIT, DO YOU THINK YOUR MOM COULD ORDER US SOME PIZZA?

HOW WILL THAT HELP?



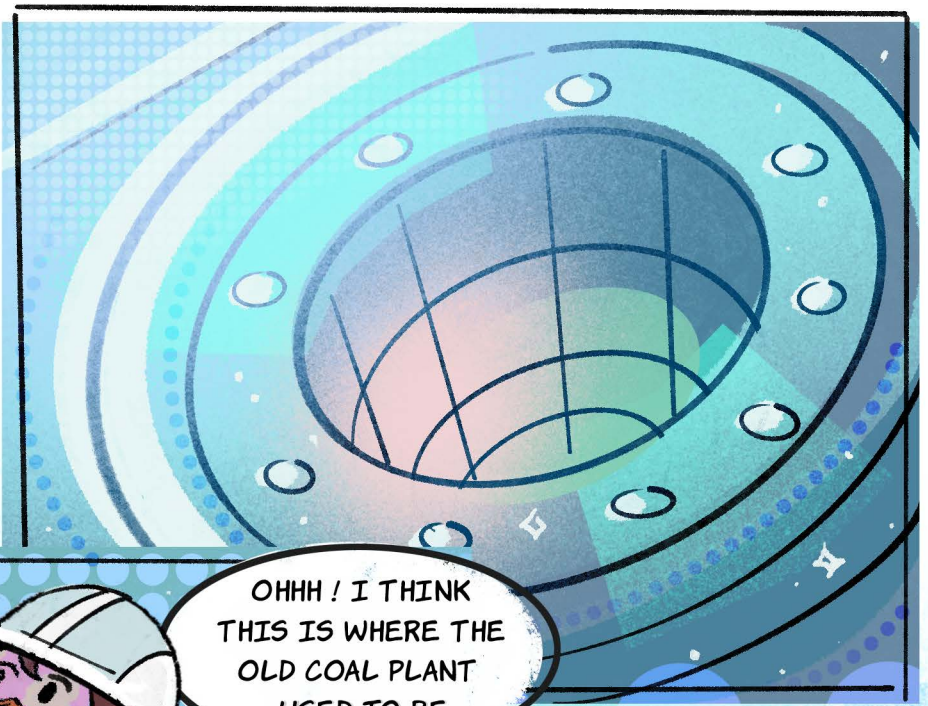
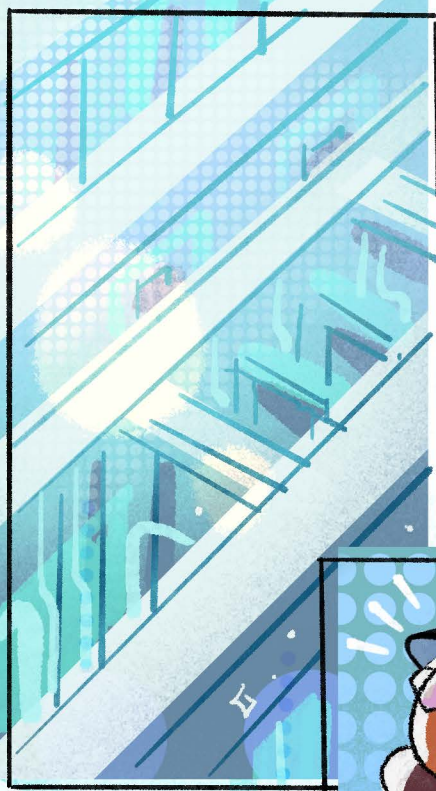
OH, I JUST FELT LIKE HAVING PIZZA.



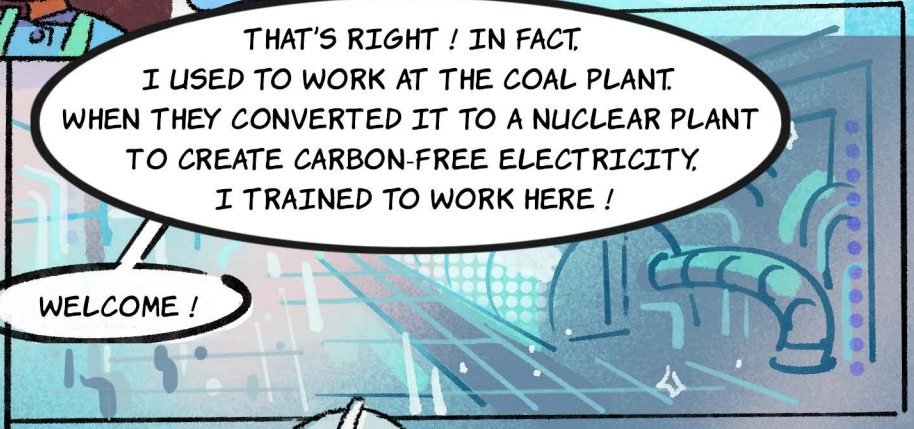
HMM... NOTHING IS WORKING.

I THINK WE HAVE TO GO TALK TO SOMEONE.



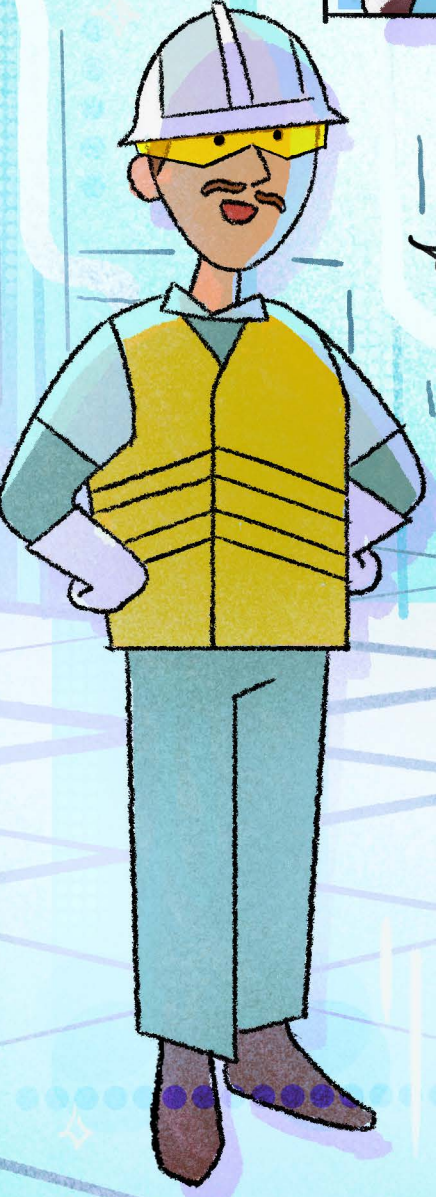


OHHH ! I THINK THIS IS WHERE THE OLD COAL PLANT USED TO BE.



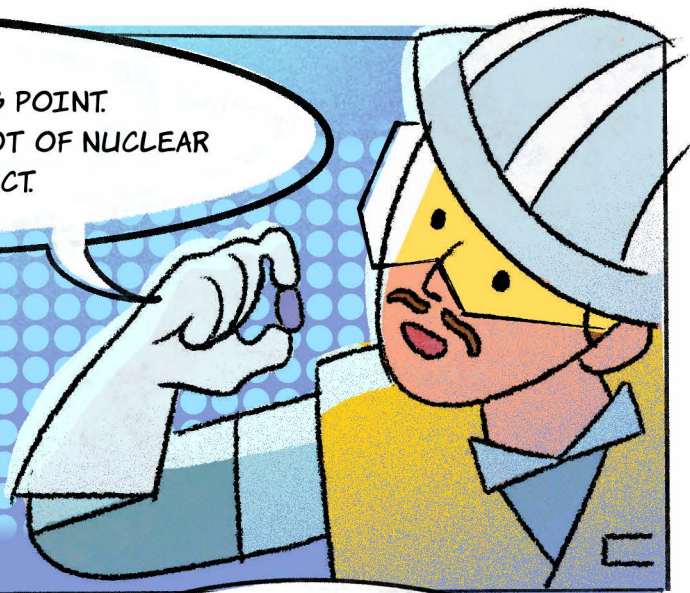
THAT'S RIGHT ! IN FACT, I USED TO WORK AT THE COAL PLANT. WHEN THEY CONVERTED IT TO A NUCLEAR PLANT TO CREATE CARBON-FREE ELECTRICITY, I TRAINED TO WORK HERE !

WELCOME !



SO ACTUALLY, THE OLD COAL PLANT IS A GOOD STARTING POINT. COMPARED TO COAL, YOU DON'T NEED A LOT OF NUCLEAR ENERGY TO MAKE A BIG IMPACT.

URANIUM FUEL IS SO CONCENTRATED THAT 1 CERAMIC URANIUM PELLETT IS EQUAL TO SAME AMOUNT OF ENERGY AS 1 TON OF COAL!

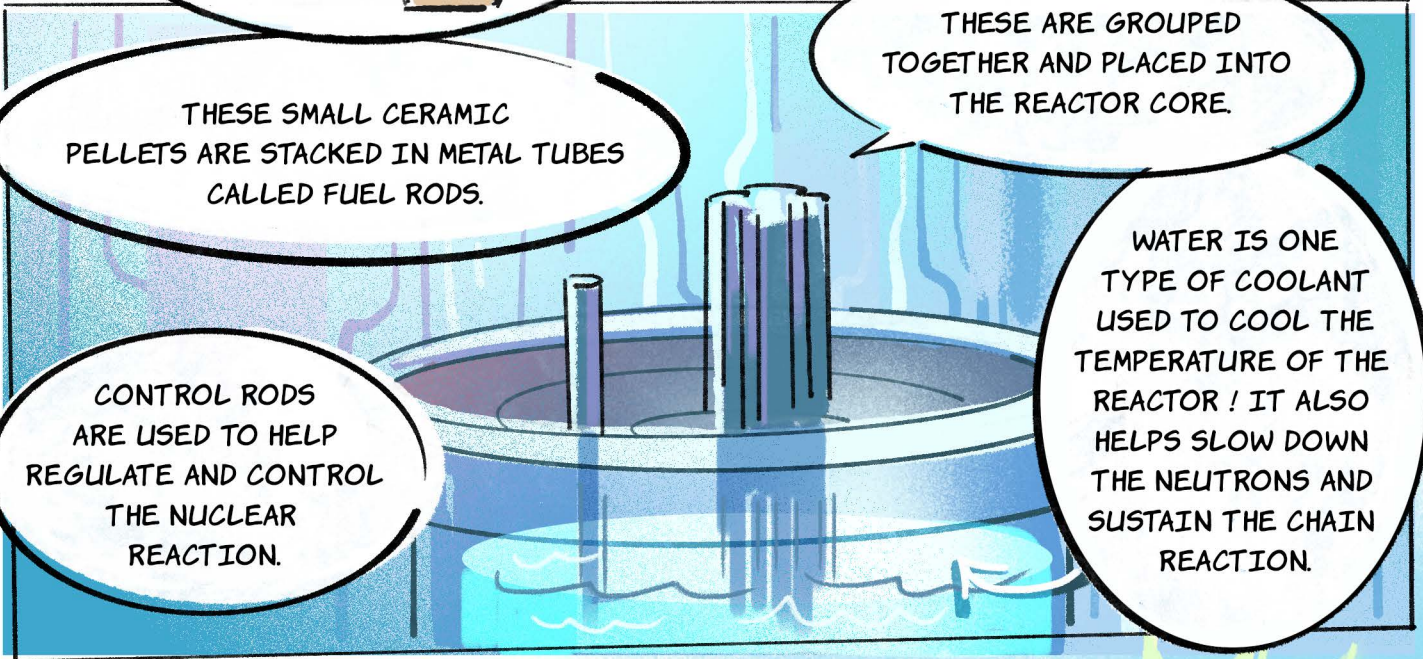


THESE ARE GROUPED TOGETHER AND PLACED INTO THE REACTOR CORE.

THESE SMALL CERAMIC PELLETS ARE STACKED IN METAL TUBES CALLED FUEL RODS.

CONTROL RODS ARE USED TO HELP REGULATE AND CONTROL THE NUCLEAR REACTION.

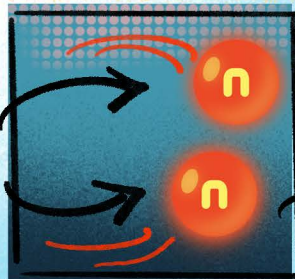
WATER IS ONE TYPE OF COOLANT USED TO COOL THE TEMPERATURE OF THE REACTOR! IT ALSO HELPS SLOW DOWN THE NEUTRONS AND SUSTAIN THE CHAIN REACTION.



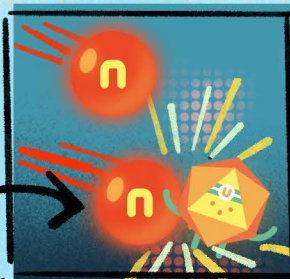
### THE REACTION ITSELF IS LIKE A DODGEBALL GAME



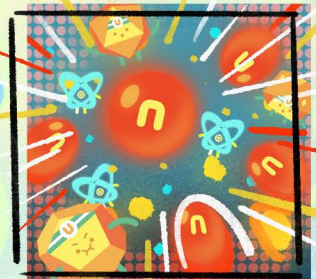
WHEN URANIUM IS HIT BY A NEUTRON



IT SPLITS AND RELEASES 2 OR 3 NEUTRONS



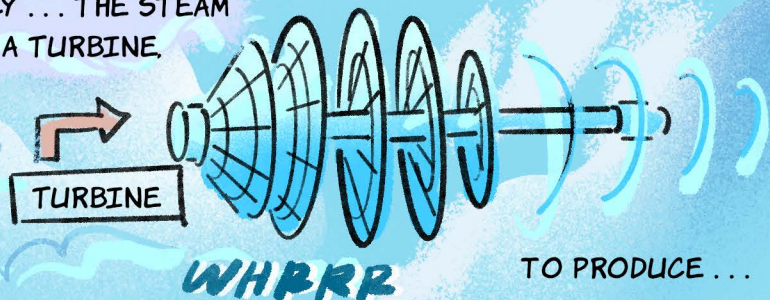
WHICH HIT OTHER U-235 ATOMS



STARTING A CHAIN REACTION!

THE CONTROLLED SPLITTING RELEASES HEAT ENERGY. THE COOLANT ABSORBS THE HEAT AND CARRIES IT AWAY TO GENERATE STEAM!

AND FINALLY ... THE STEAM SPINS A TURBINE.



TO PRODUCE ...



... ELECTRICITY !



I GOT IT !

RIGHT... SO IF WE CAN SLOW THE NEUTRONS DOWN ENOUGH, THE U-235'S CAN USE THEM AS DODGEBALLS.

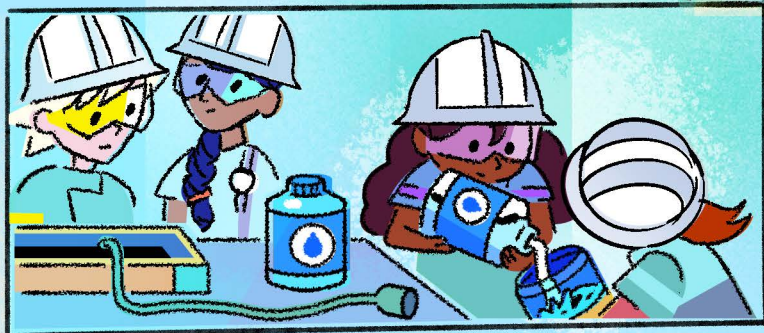
BUT HOW DO WE SLOW THEM DOWN?

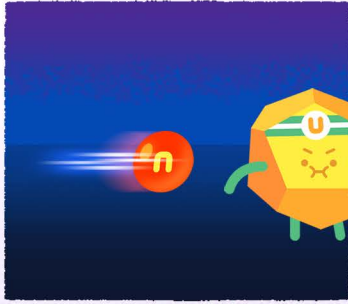
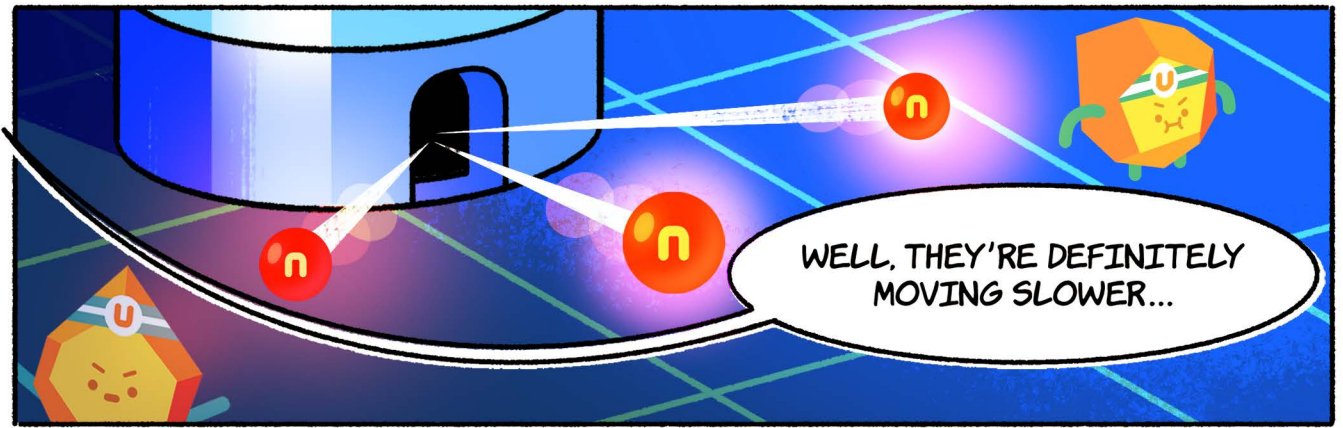
WE NEED TO GET THE PARTICLES TO PLAY DODGEBALL.



DO ANY OF YOU HAVE ANY WATER WE CAN USE?

I THINK JASMINE DOES !





OH...?



OH!

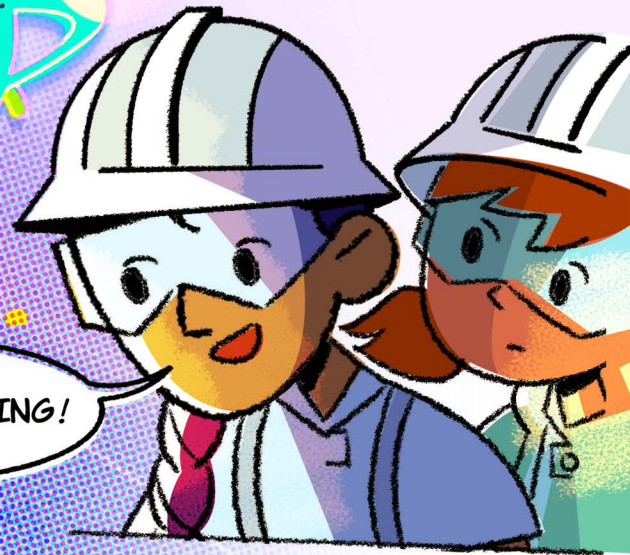


THEY MADE CONTACT!

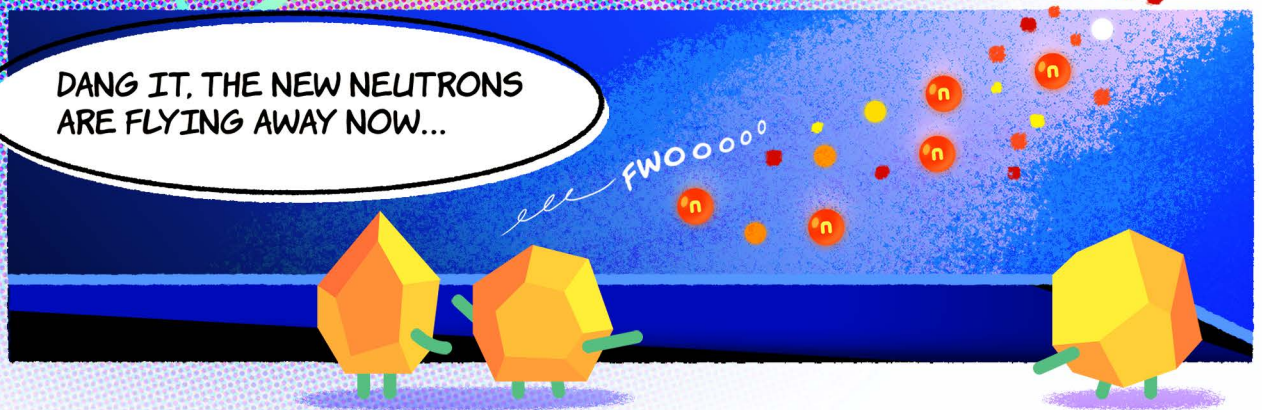
**POOF!**



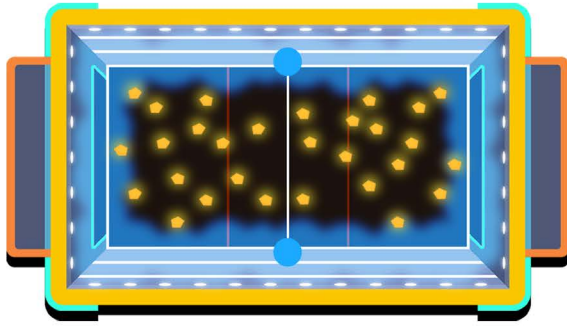
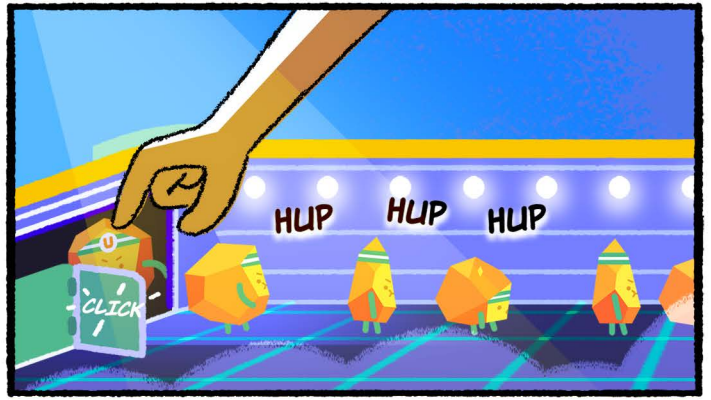
IT'S SPLITTING!



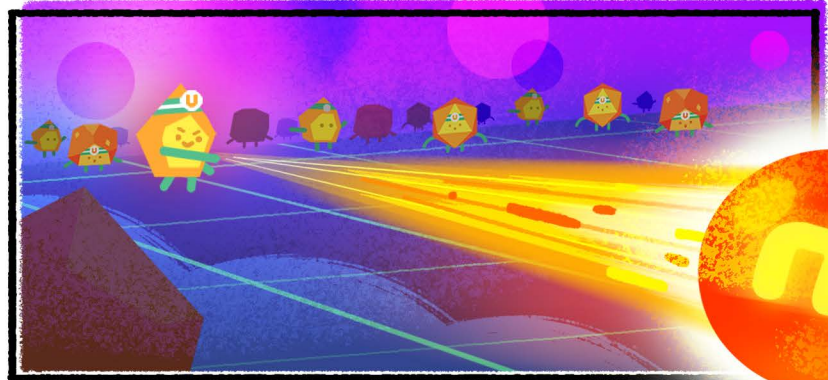
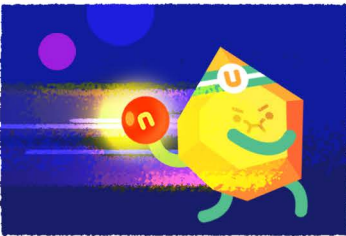
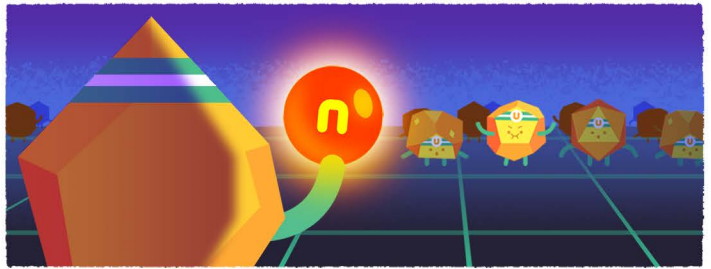
DANG IT. THE NEW NEUTRONS ARE FLYING AWAY NOW...



eee FWOOOOO!



WELL THERE ARE CERTAINLY LOTS NOW...





IT'S WORKING!  
IT'S STARTING  
A CHAIN REACTION!

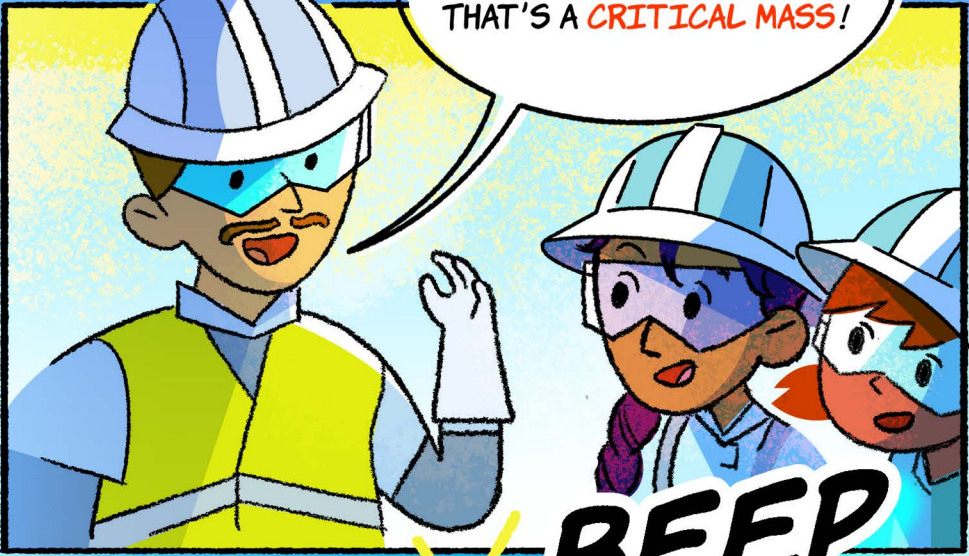


PING!

PLINK

WHOOOSH!

YOU GOT  
JUST THE RIGHT  
AMOUNT OF NEUTRONS!  
THAT'S A **CRITICAL MASS!**



**BEEP  
BEEP!!**

WE GOTTA  
SUBMIT!





WOO HOO!

BING!

YOU DID IT!  
WE'LL BE WAITING FOR  
YOU AT REGIONALS!

PHEW! THAT WAS CLOSE!

HAHA  
JUST  
LIKE  
OLD  
TIMES.

HEY DO  
YOU THINK  
YOU'LL BE  
ABLE TO  
HANG OUT AT  
THE POWER  
FAIR?

OF COURSE!

I CAN'T WAIT  
TO SEE  
WHAT YOU ALL  
COME UP WITH!





### HOW TO PLAY:

- 1) GET A FRIEND AND TWO DIFFERENT COLORS TO DRAW WITH.
- 2) TAKE TURNS CONNECTING THE ORANGE U-235 ATOMS TO FORM A HORIZONTAL OR VERTICAL LINE. YOU CAN ONLY DRAW A LINE BETWEEN 2 ATOMS AT A TIME.
- 3) IF YOU COMPLETE A SQUARE, COLOR THE NUCLEAR JOULE IN THE MIDDLE THAT YOU'VE "COLLECTED".
- 4) KEEP GOING UNTIL ALL OF THE JOULES ARE COLORED IN. WHOEVER HAS COLORED THE MOST JOULES HAS THE BIGGEST CHAIN REACTION AND WINS THE GAME!



GOOD LUCK!





READ MORE  
ENERGIZING  
ADVENTURES  
FROM THE  
SPARK SQUAD

THE SPARK SQUAD IS GETTING CLOSER TO THEIR GOAL OF MAKING IT TO THE POWER FAIR. THE TEAM IS CHARGED UP BUT HAVE A BIG OBSTACLE IN THEIR PATH: THE REGIONAL COMPETITION. IN ORDER TO QUALIFY, THE TEAM ENLISTS THE HELP OF ARIA'S OLD FRIEND DAKOTA, A RISING CELEBRITY IN THE WORLD OF NUCLEAR ENERGY. WITH DAKOTA'S KNOWLEDGE OF THIS POWERFUL BUT CLEAN & SUSTAINABLE ENERGY SOURCE, SHE MAY HOLD THE KEY TO HELP THE SPARK SQUAD CAPTURE ENOUGH JOULES TO MAKE IT TO THE POWER FAIR!



SCAN TO VISIT  
THE SPARK SQUAD  
WEBSITE



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