

Chapter one

After 2 hours of travelling on bumpy roads, you are relieved to get off the school bus and to feel a cool sea breeze on your face.

A very enthusiastic woman dressed head to toe in bright yellow welcomes your class to the Hinkwell D nuclear power station.

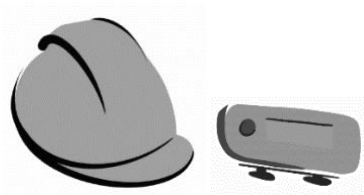
Chapter one

You are herded through a metal detector and past a security guard whilst the teacher rounds up the back of the group.

*"Come on!
Please try to keep up!"*

Chapter one

A hard hat is put on your head.



A box that flashes '0 μSv ' is stuck to your chest.

A photocopied booklet is put in your hand and the bright yellow lady sings,

"This way children, follow me."

Chapter one

You are marched through a huge hall, between two lines that mark the path, like a train of children. The train turns left and right and left again. Or maybe it was right again?

The pipes snaking around the walls and ceiling begin to spin. You just need a short break. You step to the side and take off your hard hat.

Chapter one

Your shoelace is untied so you bend down to tie it. When you stand up you bang your head. It really hurts. You close your eyes and rub it. When you open your eyes everything seems very quiet. You cannot see the train of children anymore....

Page 24 to try to find the group.

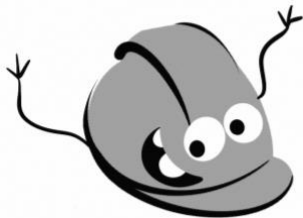
Page 14 to look in your booklet for information.

Chapter five: Control Room

A voice above you says,

"I wouldn't do that if I was you.

We have to sort this out or it
could be very bad".



Page 13 to have a look at the wall
of flashing lights.

Page 51 to look in your booklet.

Chapter three: Fuel Pond

So the hovering fuel bundle must be very radioactive...

Page 22 if you think you should find a safer way.

Page 27 to look for a shield.

Page 19 to run to the control room door.

Chapter two: Fresh Fuel Store

Huge metal towers loom over you. It is like being in a metal forest!

But... It is so quiet... There does not seem to be anyone around....

Page 41 to look in your booklet for information.

Page 17 to have a look around

Page 32 to check the map for where to go next.

Chapter four: Turbine hall

This door says 'Control room'!
But it is locked... There is a
keypad to unlock it...



Page 18 to type 'loop'.

Page 37 to type 'electromagnetic'

Page 15 to type in 'steam'.

Chapter three: Fuel Pond

*"Woah there! I wouldn't do that
if I were you!"*

You look around. You cannot
see anyone anywhere.

"Up here!"

You take your hard hat off. It
has changed.... Somehow... It
has a face?

Page 21 to continue.

Chapter two: Fresh Fuel Store

You wonder if the metal towers are fuel for the reactor? And if they are then how much power could all of these produce?

Page 41 to look in your booklet for information.

Page 17 to have a look around.

Chapter three: Fuel Pond

The fuel pond looks like a huge swimming pool. There are lots of fuel bundles under the water and there is one hovering in the air attached to a crane.

Maybe someone was lowering that one into the fuel pond swimming pool when everyone disappeared...

Page 16 to continue.

Chapter five: Control Room

A screen says, 'Chain reaction out of control, power overload'. You wonder if you can lower the power somehow.

One of the levers is labelled 'control rods'.

Page 23 to lower the control rods.

Page 38 to raise the control rods.

Page 51 to look in your booklet.

Chapter one

The front of the booklet has a useful map.

It looks like the first stop of the tour is the fresh fuel store... That must be where everyone has gone!

There is a sign up ahead that says 'Fresh fuel store'.

Page 8 to follow the sign.

Chapter four: Turbine hall

The lock clicks and the door opens! Steam does turn the turbine to generate electricity in a nuclear power plant!

Page 30 to go through the door to the control room.

Chapter three: Fuel Pond

The box on your chest starts beeping and the numbers are going up!



There is a door labelled 'Control room' across the other side!

Page 10 to walk towards the door.

Chapter two: Fresh Fuel Store

There is not much in this room.

Page 11 to look between the metal towers.

Page 36 to look on the desk.

Page 20 to look at that door.

Chapter four: Turbine hall

That didn't work...

There must be some kind clue
somewhere... and somewhere
to look for information...

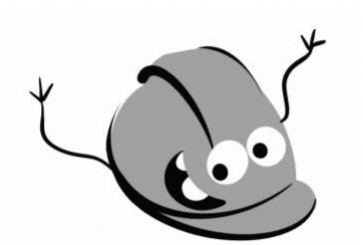
Page 29 to look at that desk.

Page 47 to check your booklet for
information.

Chapter three: Fuel Pond

A voice above you says,

"Running will reduce how long you are exposed to radiation for but you could slip and fall!"



Page 22 if you think you should find a different way.

Page 27 to look for a shield.

Chapter two: Fresh Fuel Store

The door says, 'Fuel pond, high dose rate, do not enter'. It seems to be locked...



Page 28 to try 300.

Page 40 to try 193.

Page 34 to try 150.

Chapter three: Fuel Pond



*"Trust me, if the box is bleeping,
it means something. I don't like
the look of that fuel bundle
hovering there. Put me back
on your head before you bang
it again!"*

Page 44 to look in the booklet for
information.

Chapter four: Turbine hall

You go back to the fresh fuel store and find another door.

This one is labelled 'turbine hall' and opens into a very large room. It might take longer to get to the control room this way but it is safer.

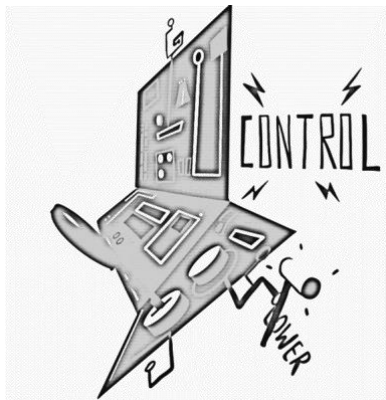
Page 9 to look around for a door.

Page 29 to look at some papers on a desk.

Page 47 to check your booklet.

Chapter five: Control Room

You see the power dial go down! The control rods must be absorbing neutrons to limit the number of nuclear reactions.



Page 31 to proceed to the exit.

Chapter one

You rush forward to look around another corner but cannot see anyone there. It is so strange, it is as if everyone has vanished.

Surely you can work out where they have gone...

Page 14 to look in your booklet for information.

Chapter four: Turbine hall

So a nuclear power plant is not very different from other power stations and wind turbines...

Page 9 to look around for a door.

Page 29 to look at some papers on a desk.

Chapter two: Fresh Fuel Store

So these metal towers are the fuel bundles....

Page 17 to have a look around.

Page 32 to check the map for where to go next.

Chapter three: Fuel Pond

If the booklet is correct, then you should be able to use a shield to reduce the radiation dose.

You find a large piece of cardboard and a large piece of aluminium.

Page 33 to use the cardboard.

Page 39 to use the aluminium.

Chapter two: Fresh Fuel Store

For a typical pressurised water reactor there are 300 fuel pellets in a fuel bundle.

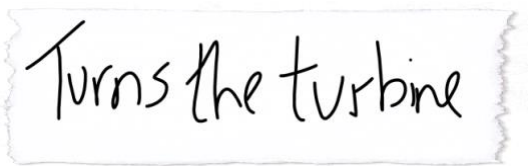


Page 36 to have a look for a clue.

Page 41 to check the booklet for information.

Chapter four: Turbine hall

You find another piece of paper in the same handwriting as before... It should not be too hard to figure out the answers again...



Turns the turbine

Page 9 to look around for a door.

Page 47 to check your booklet for information.

Chapter five: Control Room

Every wall is covered in buttons.
All of the lights on one of the
walls are flashing and a
mechanical voice booms,

“Attention. Attention.”

But there is no one here to pay
it attention. Apart from you...

Page 6 to go to the exit.

Page 13 to have a look at the wall
of flashing lights.

Page 51 to look in your booklet.

The End

Wow what a day! You cannot wait to get back on the bus!

If you enjoyed the school trip please pass this book on to a friend!

Chapter two: Fresh Fuel Store

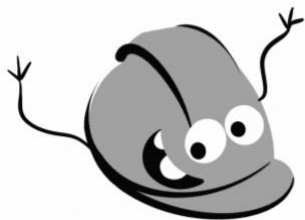
It is difficult to know where the tour would go next... It looks like the fuel pond would be the quickest way to get to the control room and get back to the bus. The silence is so eerie, it would be best to get out as soon as possible.

Page 41 to look in your booklet for information.

Page 17 to have a look around.

Chapter three: Fuel Pond

A voice above you says,
*"Cardboard isn't dense enough
to stop this type of radiation."*



Page 39 to try the aluminium
shield.

Chapter two: Fresh Fuel Store

For a typical pressurised water reactor there are 150 fuel bundles in a nuclear reactor.



Page 36 to have a look for a clue.

Page 41 to check the booklet for information.

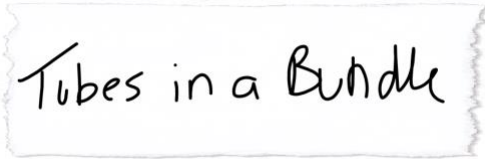
Chapter five: Control Room

The moderator and fuel are fixed in the reactor... But the control rods are moveable.... So if you want to control the power then you'd need to move the control rods...

Page 13 to have a look at the wall of flashing lights.

Chapter two: Fresh Fuel Store

You find a handwritten note.
Maybe somebody wrote
themselves a clue to help them
to remember a password...



Tubes in a Bundle

Page 41 to look in your booklet
for information.

Page 17 to have a look around.

Chapter four: Turbine hall

That didn't work...

There must be some kind clue
somewhere... and somewhere
to look for information...

Page 29 to look at that desk.

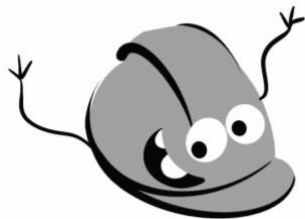
Page 47 to check your booklet for
information.

Chapter five: Control Room

A voice above you says,

*"To decrease the power we
need to absorb more neutrons.*

*Control rods absorb neutrons
so there needs to be more of
them in the reactor."*



Page 23 to lower the control rods.

Chapter three: Fuel Pond

The shield is slightly bigger than you but you can carry it. You hold the shield between yourself and the hovering fuel bundle. You get to the door! The box only says $9 \mu\text{Sv}$, that doesn't seem too much.

Page 30 to go through the door to the control room.

Chapter two: Fresh Fuel Store

For a typical pressurised water reactor there are 193 fuel pins in a fuel bundle. The lock clicks and the door is open.



Page 12 to go through the door.

Chapter two: Fresh Fuel Store

Nuclear fuel is made from uranium that is mined from the earth.

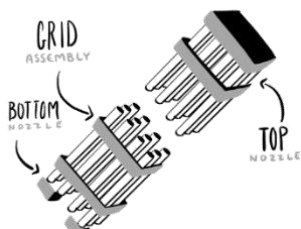
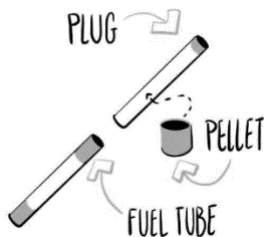


The uranium ore is crushed and chemically processed to form a yellow powder. The percentage of isotopes is enriched.

The powder is pressed to form pellets. Continue.

Chapter two: Fresh Fuel Store

For the most common reactor designs, about 300 pellets are stacked in a fuel pin.



193 fuel pins are put into a fuel bundle.

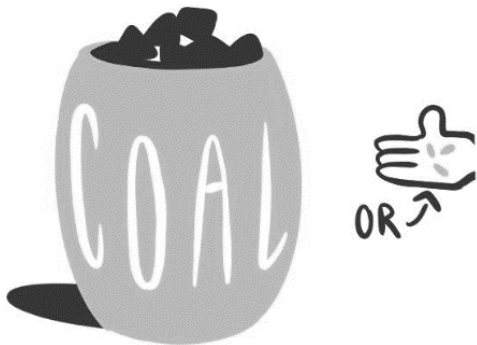
150 fuel bundles are in a typical reactor core.

Continue.

Chapter two: Fresh Fuel Store

Uranium is very energy dense.

3 pellets produce more electricity than one drum of coal.



Page 26 to continue.

Chapter three: Fuel Pond

After nuclear fuel has been in a nuclear reactor it is very radioactive.

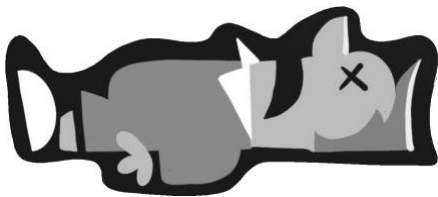


The radioactivity gradually decreases but for the first 5 years after being in a reactor, nuclear fuel needs to be stored under water. Continue.

Chapter three: Fuel Pond

Radiation damages the cells in our bodies.

If you are exposed to a large amount of radiation in a short amount of time you would become very sick and die.



If you are exposed to a smaller but significant amount frequently you would be more likely to develop cancer. Continue.

Chapter three: Fuel Pond

To reduce our radiation dose we use time, distance and shielding.

Reduce the amount of time you are exposed radiation.



Increase the distance between you and the radioactive item.

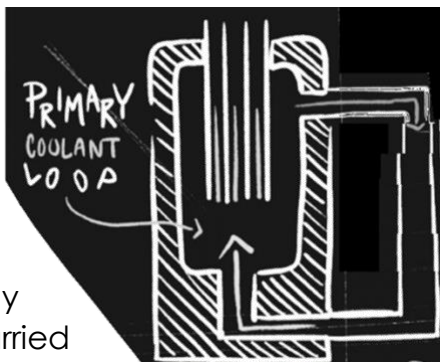
Use a shield that can absorb the energy of the radiation.



Page 7 to continue.

Chapter four: Turbine hall

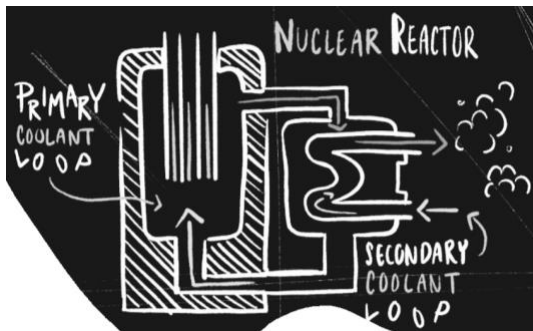
Energy released in nuclear reactions becomes heat energy.



This heat energy is carried away by water that flows through the nuclear reactor core and around the primary coolant loop.

Continue.

Chapter four: Turbine hall



The water in the primary coolant loop transfers its heat to water in a secondary coolant loop.

The water in the secondary coolant loop boils to produce

steam.

Continue.

Chapter four: Turbine hall

This steam turns a turbine. When magnets move, an electrical current can be induced in a wire by electromagnetic induction.



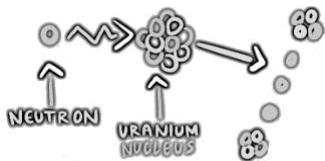
This electrical current then supplies the national grid.

Page 25 to continue.

Chapter Five: Control Room

Inside a nuclear reactor vessel energy is released by nuclear fission.

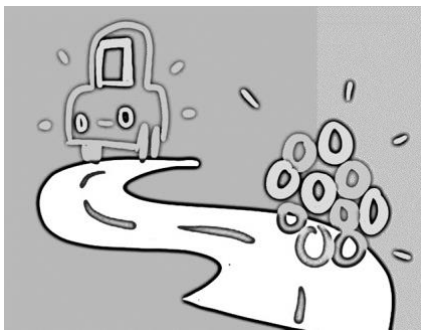
Uranium atoms are unstable. So when a neutron bumps into a uranium atom, it splits into two smaller atoms and 2 or 3 neutrons and lots of energy is released.



These neutrons could then cause another uranium atom to split apart but to begin with they are too fast. Continue.

Chapter Five: Control Room

Imagine if you walk across a road or run across a road. If you go slower you are more likely to collide with a car.

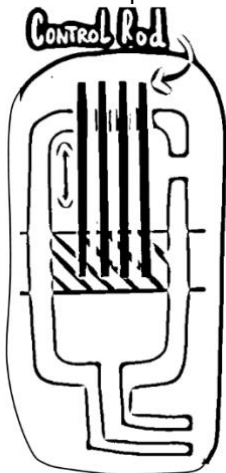


A moderator slows the neutrons down so that they collide with uranium atoms. Continue.

Chapter Five: Control Room

If one fission event caused 2 or 3 more fission events then you would release more and more power and you would lose control of the chain reaction.

So control rods can be inserted into the core to absorb neutrons and control the power.



Page 35 to
continue.