Industrialcraft² Nuclear Reactor Owner's Manual

By Inucune

Nuclear Fuel-Refining Process

- The first step to creating an IC2 reactor is locating and refining nuclear material.
- While some players may refine uranium completely, others may stockpile fuel in different stages of the refining process for easier handling.
- Uranium ore is the primary source of fissionable radioactive materials in IC2.
- Uranium ore is green and requires an iron pickaxe or better to mine.
- Uranium ore is safe to handle without any special equipment.

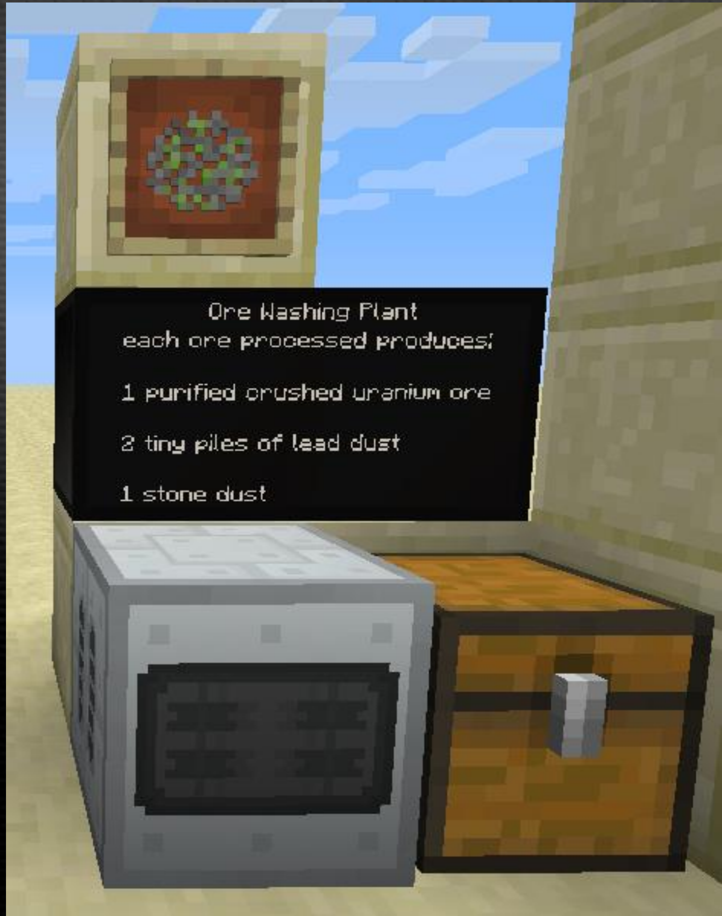
Refining Uranium-Maceration

- The first step of processing uranium for use as fuel is to macerate(or grind) the ore.
- Each uranium ore placed in the macerator (shown to the right) produces 2 crushed uranium ore.

Refining Uranium-Ore Wash

- The next step is to process crushed uranium ore in the ore wash(shown to the right). This requires 1000mB(1 bucket or cell) of water per crushed ore.
- Each crushed uranium ore processed will output:

  1 purified crushed uranium ore
  2 tiny piles of lead dust
  1 stone dust



Refining Uranium-Thermal Centrifuge

- The Thermal Centrifuge is expensive but necessary for Uranium refining.
- Once purified crushed uranium ore is placed in the Thermal Centrifuge, the Centrifuge will begin warming up to a set temperature. Once the Centrifuge reaches temperature, it will begin processing the ore. This process requires a large amount of power and will fail if there is insufficient power.
- Each processed ore produces:

  5 Uranium 238

  2 tiny pieces of uranium 235

- These materials are highly radioactive and will damage the player.

Refining Uranium-Safety First!

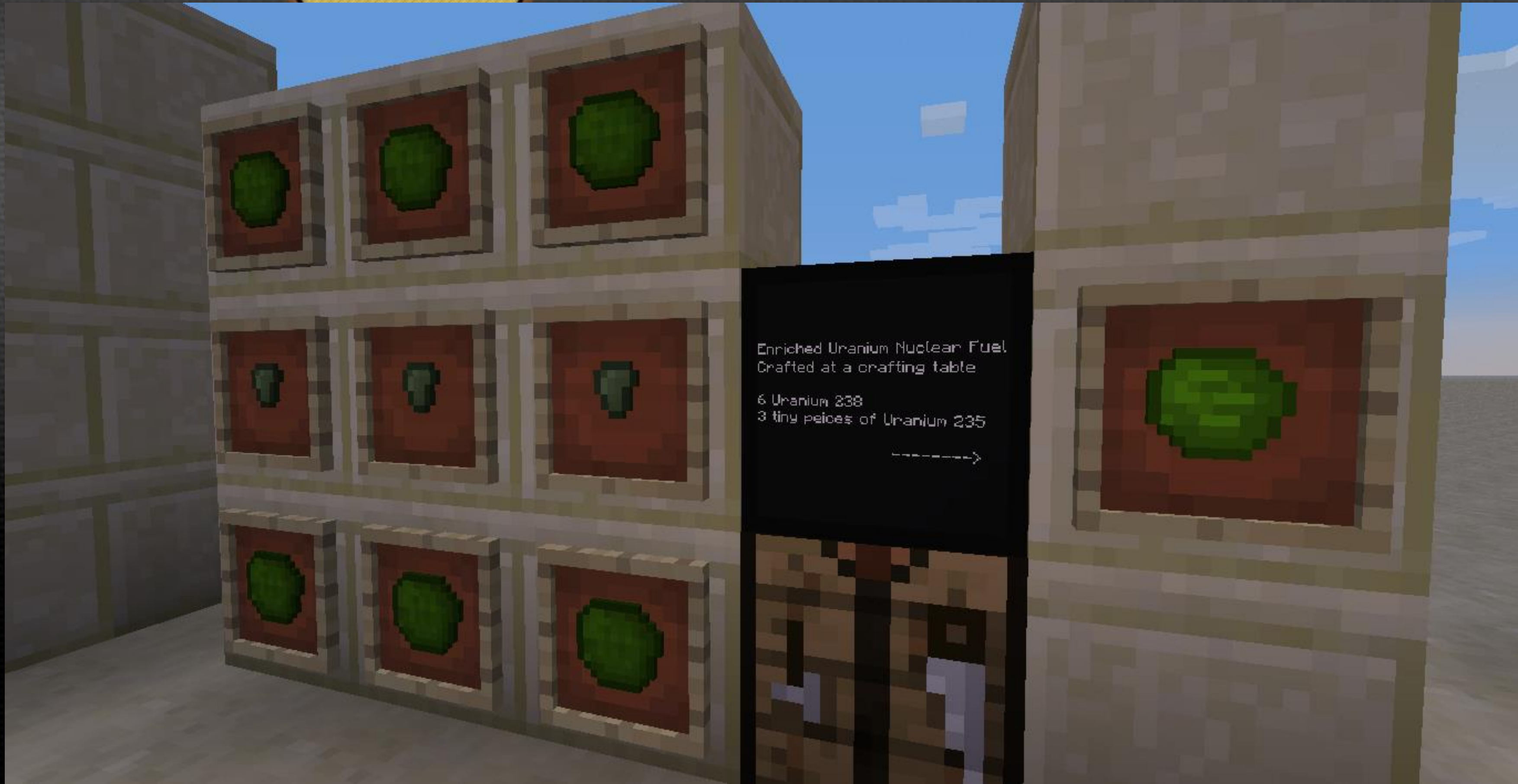
- Radioactive materials removed from the thermal centrifuge will cause ongoing damage to the player(.5 hearts) until a period of time AFTER the source is removed from inventory.
- A full hazmat suit (shown to the right) will protect the player from most environmental sources of damage, including radiation both from operating reactors and from sources in the player’s inventory.

Tip: keep a spare on hand at all times.

Refining Uranium-Refining Uranium-Enriched Uranium Nuclear Fuel Recipe

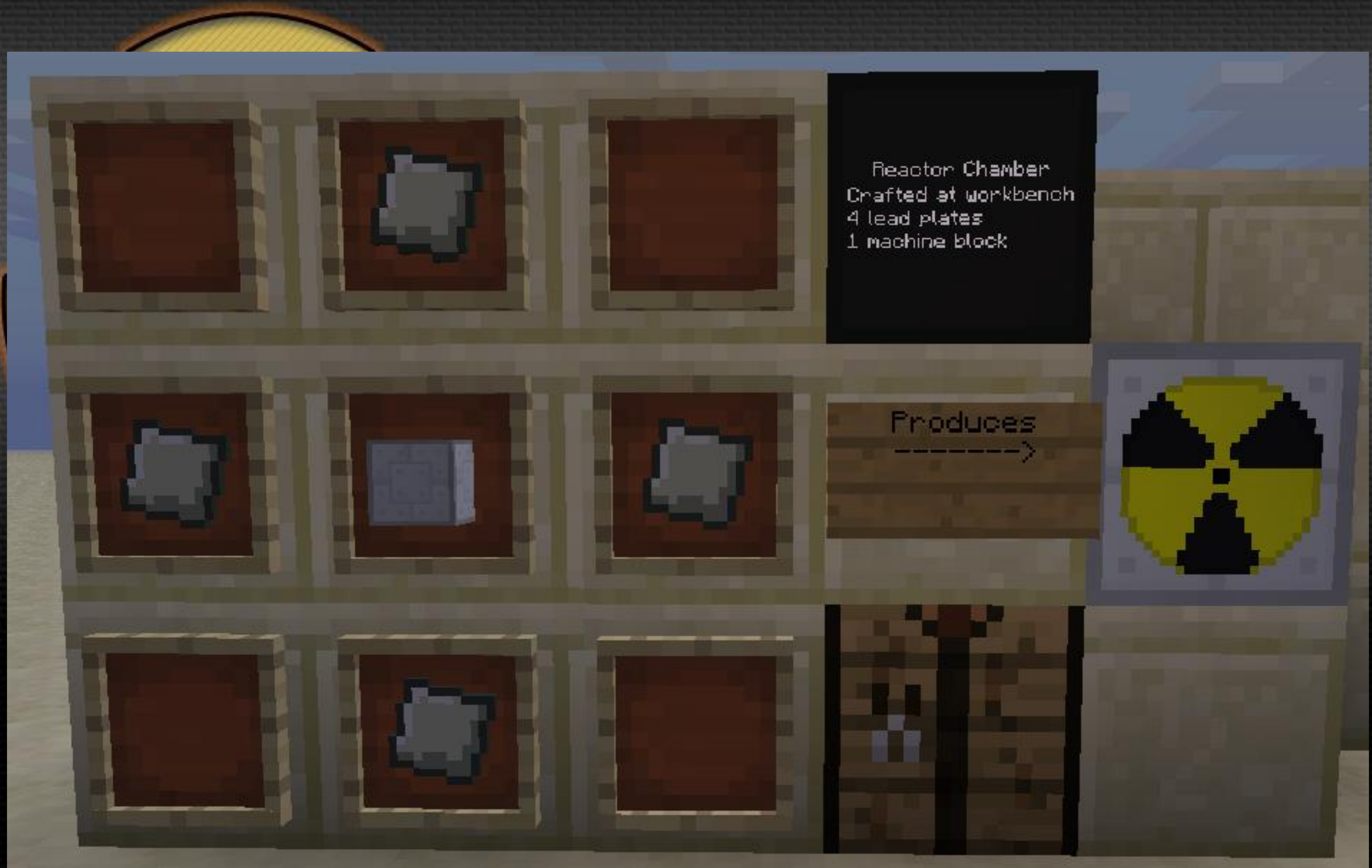
- Enriched uranium nuclear fuel is produced as follows at a crafting table:
- 6 uranium 238
- 3 tiny pieces of uranium 235

- Enriched Uranium Nuclear fuel is then placed in the canning machine with an empty fuel rod(extruded iron plate) to make a fuel rod.



Reactor Operation- Reactor Construction

- The first step in building a reactor is to create 3 reactor chambers.
- A reactor chamber is made by placing 4 lead plates around a machine block.
- Reactor chambers can later be used to expand the internal space of a reactor.



Reactor Operation- Reactor Construction

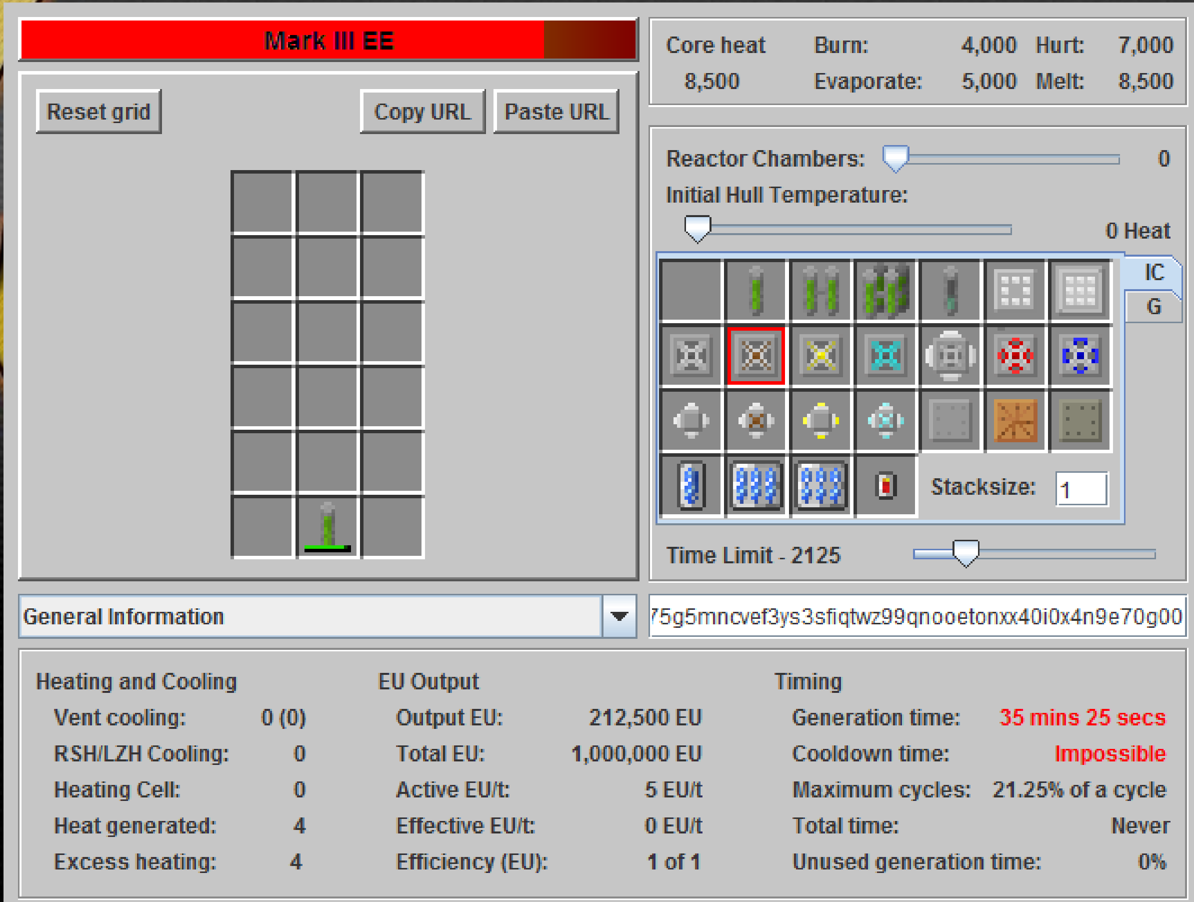
- The Nuclear reactor is constructed from:

3 reactor chambers
4 dense lead plates
1 generator
1 advanced circuit

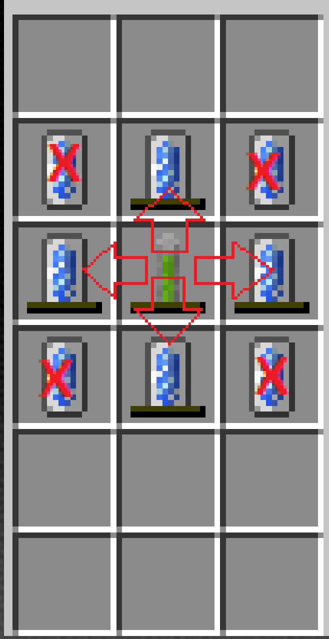
- This block acts as the primary block for the reactor to which the chambers are later attached for expansion.

Reactor Operation-Basic Physics

- In order to generate power(EU), a reactor needs fuel and a redstone signal.
- 1 fuel cell(Shown to the right) will generate 5 eu/t (5 EU per tick), and 4 units of heat per tick.
- A single uranium cell has a 'life' of 4 hours, 46 minutes and 40 seconds.
- As the image to the right shows, a reactor with one cell and no cooling will blow up after about 35 minutes and 25 seconds of operation.



Reactor Operation-Basic Physics

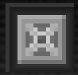


- Any heat produced by a Uranium cell is dispersed evenly into all adjacent components able to accept heat.
- Items that are diagonally arranged are not considered adjacent, and will not receive heat.
- Reactors do not passively cool themselves.
- The following components are able to accept heat from cells (shown to the lower right):

Heat vent
overclocked heat vent
RSH-condensator
heat exchanger
component heat exchanger
10K coolant cell
60k coolant cell

reactor heat vent
advanced heat vent
LZH-condensator
reactor heat exchanger
advanced heat exchanger
30k coolant cell

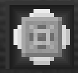
Reactor Operation-Cooling Components



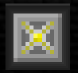
- Heat Vent-Dissipates 6 heat from itself per tick

- Reactor Heat Vent-Dissipates 5 heat from itself and 5 from the reactor vessel per tick

- Advanced Heat Vent-Dissipates 12 heat from itself per tick



- Component Heat Vent-Dissipates 4 heat from each surrounding component. Does not accept heat itself.



- Overclocked Heat Vent-Moves up to 36 heat from the reactor to itself and dissipates 20 from itself. Prone to overheating.

- All Vents can contain up to 1k heat before melting.

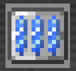
Reactor Operation-Heat Exchangers

- Heat Exchanger-Transfers up to 12 heat between adjacent components and itself, then 4 with the hull. Can contain up to 2500 heat before melting
- Advanced Heat Exchanger-Transfers up to 24 heat between adjacent components and itself, then 8 with the hull. Can contain up to 5000 heat before melting
- Reactor Heat Exchanger-Transfers up to 72 heat with the hull, but does not move heat between components. Can contain up to 2500 heat before melting.
- Component heat exchanger-Transfers up to 36 heat between adjacent components, but does not move heat between the hull and itself. Can contain up to 2500 heat.

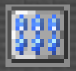
- All components transfer heat based on percentage of capacity.

Reactor Operation-Condensators and cooling cells

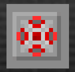
- 10K Coolant Cell-Holds up to 10k heat before melting. Does not dissipate or transfer heat.



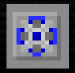
- 30K Coolant Cell-Holds up to 30k heat before melting. Does not dissipate or transfer heat.



- 60K Coolant Cell-Holds up to 60K heat before melting. Does not dissipate or transfer heat.

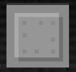


- RSH-Condensator-Absorbs and disperses heat instantly. Can absorb 20k heat before becoming inert. Must be recharged with redstone at a crafting table. Each redstone restores 10k cooling potential.

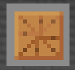


- LZH-Condensator-Behaves the same as the RSH-Condensator, except that it can absorb 100K heat and additionally be recharged with lapis lazuli. Each redstone restores 5k cooling and each lapis lazuli restores 40k.

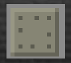
Reactor Operation-Reactor Plating



- Reactor Plating-Increases the max reactor hull heat capacity by 1000 and reduces the blast radius in the event of a meltdown by 5%



- Heat-Capacity Reactor Plating-Increases the max reactor hull heat capacity by 1700, but only reduces the blast radius in the event of a meltdown by 1%

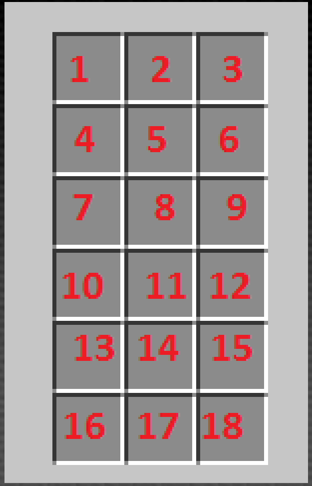


- Containment Reactor Plating-Increases the max reactor hull heat capacity by 500, but reduces the blast radius in the event of a meltdown by 10%

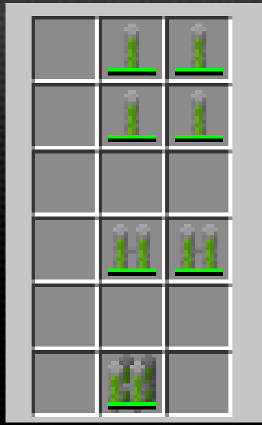
- Each reactor plate occupies 1 slot in the reactor. The effects of each plate stacks with the effects of other plates in the reactor. It is safe to set reactor plates directly adjacent to fuel rods without fear of the plates melting.

Reactor Operation-Adjacent Fuel and Operational Order

- The reactor will update each component individually, from left to right and top to bottom. This update is done every tick, even if there is no redstone signal.
- The best general placement of components is to have cooling components near the top of the grid, and components which generate heat near the bottom of the reactor.

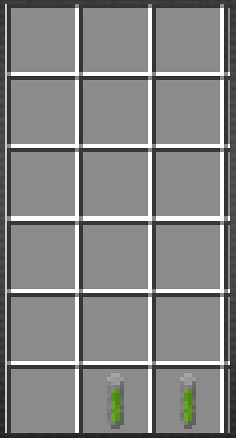


- Adjacent fuel cells increase the amount of power(and heat) each fuel cell produces. Two fuel cells placed adjacently generate the same amount of power and heat as a dual fuel cell, and a quad fuel cell generates as much power and heat as 2 dual fuel cells placed next to each other or 4 single fuel cells placed in a square. The main use of dual and quad cells is space conservation in advanced reactors.
- Cells that are not adjacent do not influence each other.



Reactor Operation-Adjacent Fuel in Depth

- Each fuel cell generates 1 ‘pulse’ of EU and heat. This pulse is sent to each adjacent component. A fuel cell that receives a ‘pulse’ from an adjacent cell generates an additional amount of energy equivalent to an additional pulse.
- For example, in the image to the right, the first cell would emit a pulse, generating 5 EU. The second cell would receive this pulse, and also generate 5 EU. Next, the second cell would emit a pulse, generating 5 EU. The first cell would receive this pulse, and also generate 5 EU. The reactor is now producing 20eu/t. These additional pulses do not affect the lifecycle of the cells.



- However, this increased efficiency comes at a cost: Heat.
- Each uranium cell will produce 2 * efficiency * (efficiency + 1) heat per second, where efficiency is each adjacent cell (rod count, not square).

Reactor Operation-Fuel Recycling and MOX

- After a fuel cell reaches the end of its life (sometimes called a cycle), it becomes a depleted cell. These cells are still radioactive and must be handled with care.

- Depleted cells can be run through the thermal centrifuge, allowing the player to reclaim the iron(dust) from the rod(s), and an amount of uranium 238. In addition, a small piece of plutonium will be extracted(1 per rod).

- Plutonium has 2 uses: Mox Cells and RTG fuel.

- Mox cells have a shorter life than normal fuel cells, but produce more energy per tick at higher temperatures.

Reactor Operation-MOX Fuel

- 9 tiny pieces of plutonium can be merged at the crafting table into 1 piece of plutonium. 3 of these larger pieces are required to make MOX fuel.

- Mox fuel requires 3 pieces of plutonium and 6 uranium 238.

- Mox fuel rods are made in the same manner as Uranium fuel rods.

- RTG Fuel Pellets require 6 dense iron plates and three pieces of plutonium. RTG fuel is used in the Radioisotope Thermoelectric generator and last forever, producing a low amount of EU and no heat. RTG fuel pellets are still radioactive and must be handled with care.

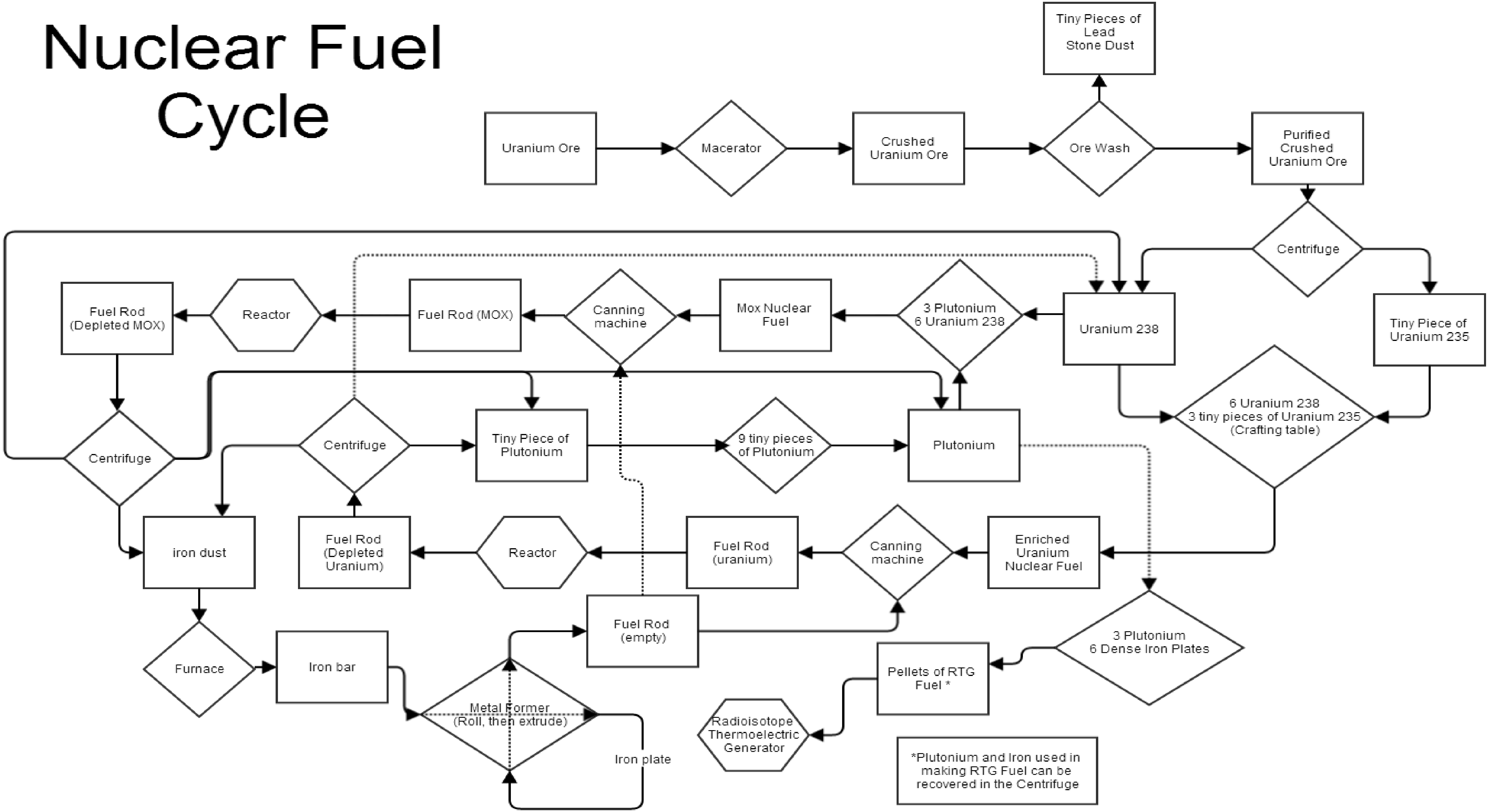
Reactor Operation-MOX Fuel

- MOX EU output follows a different algorithm.
- MOX efficiency: reactor hull heat/reactor max temperature
- EU output: 4*MOX efficiency +1

- This allows reactors running at higher temperatures to output higher amounts of EU/t. However, running reactors at these temperatures becomes dangerous.

- Depleted MOX cells can be recycled for a greater gain in plutonium.

Nuclear Fuel Cycle



Reactor Operation-Visual Status and Temperature

- A reactor will behave differently depending on how much heat is stored in the hull.

- A reactor that has less than 40% max hull heat capacity will not pose any risk to the player or environment.

Reactor Operation-Visual Status and Temperature

- At 40% max hull heat capacity, flammable blocks within a 5x5x5 cube have a chance of burning. This area is marked by redstone in the image to the right.

- The reactor will begin to emit smoke particles.

Reactor Operation-Visual Status and Temperature

- **At 50% max hull heat capacity, water blocks within a 5x5x5 cube have a chance of evaporating. This includes flowing and source blocks.**
- **The reactor will increase smoke and emit fire particles briefly.**
- **This is in addition to previous effects.**

Reactor Operation-Visual Status and Temperature

- At 70% max hull heat capacity, entities within a 7x7x7 cube will get hurt from radiation and extreme temperatures. This does 1.5 hearts/second.

- Players, mobs and animals are all considered entities.

- Smoke and fire particles will increase.

Reactor Operation-Visual Status and Temperature

- At 85% max hull heat capacity, Blocks within a 5x5x5 cube have a chance of burning, turning into flowing lava, and finally being destroyed.
- In the picture to the right, reinforced stone shows the affected area. Redstone lamps show the additional area affected by previous effects.

Reactor Operation-Visual Status and Temperature

- At 100% max hull heat capacity, the reactor is destroyed and all blocks and entities in the vicinity are immediately removed depending on hardness.

- Do not recommend.

- A 3-meter(3 blocks) thick wall of reinforced stone will contain even the most volatile reactor explosion.

Acknowledgements

- A big thanks to Alblaka, SirusKing, Player, RichardG867, Greg, and the rest of the IC2 crew for their continued development of IC2 and the Wiki page.
- IC2 Forum: forum.industrial-craft.net
- IC2 Wiki: http://wiki.industrial-craft.net

- Thank you Shedar, creator of Nuclear Control. This project would have been much harder without it. Link to Nuclear Control: forum.industrial-craft.net/index.php?page=Thread&threadID=5915

- Thank you Talon for Reactor Planner, saving hours of experiments
- Reactor Planner v3 link: http://www.talonfiremage.pwp.blueyonder.co.uk/v3/reactorplanner.html
- Thanks to Kate for her assistance with editing.