



## Structural Firefighting

A realistic look at modern firefighting...







New South Wales

8 million population  
800,000 km<sup>2</sup>

Sydney

5.3 million population  
12,300 km<sup>2</sup>



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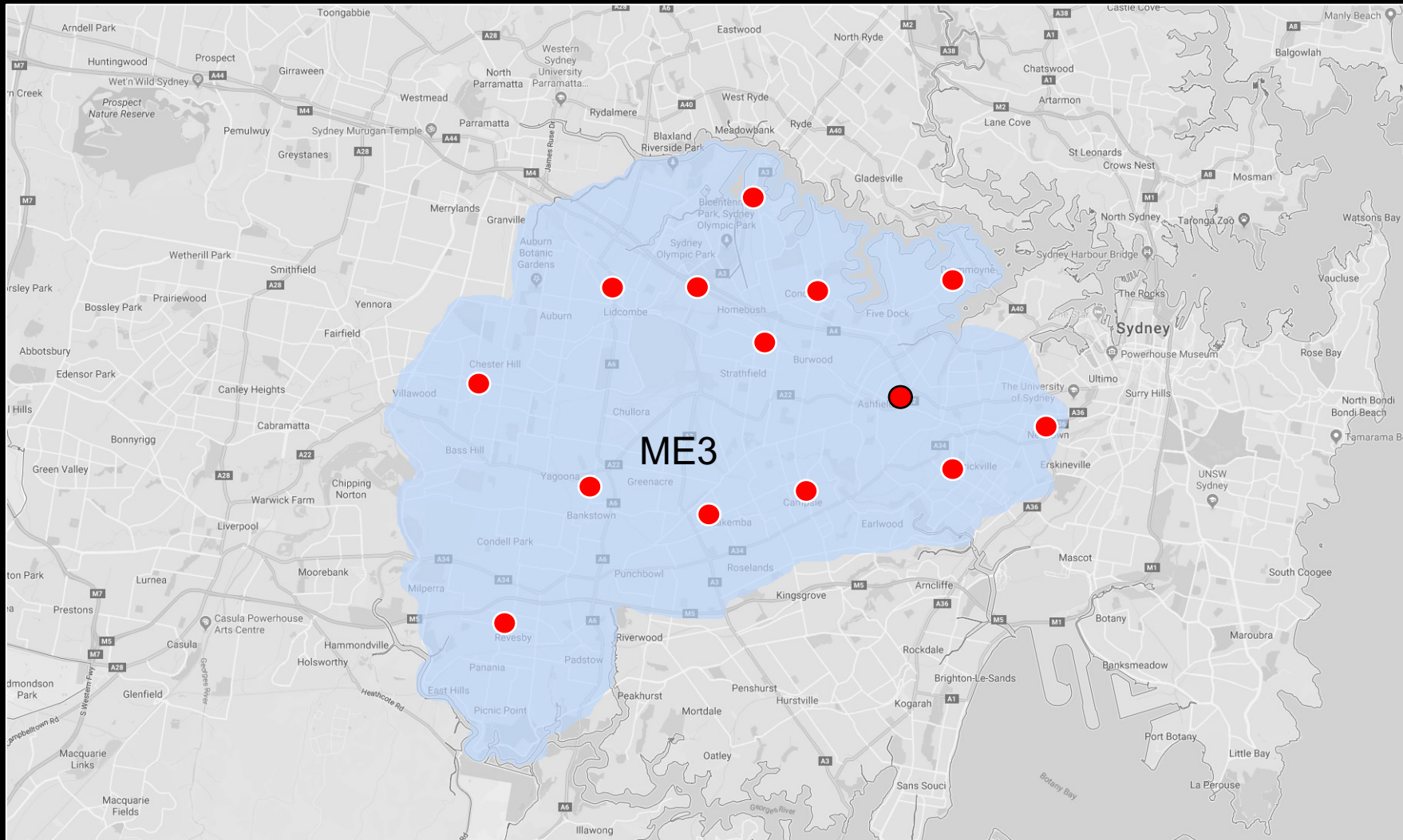




## Metro East 3 Inner West

5 Newtown  
14 Ashfield  
15 Burwood  
16 Concord  
17 Drummoyne  
19 Silverwater  
28 Marrickville  
30 Lidcombe  
47 Revesby  
52 Campsie  
62 Bankstown  
64 Lakemba  
66 Rhodes  
85 Chester Hill

1 of 9 zones in  
the gSa



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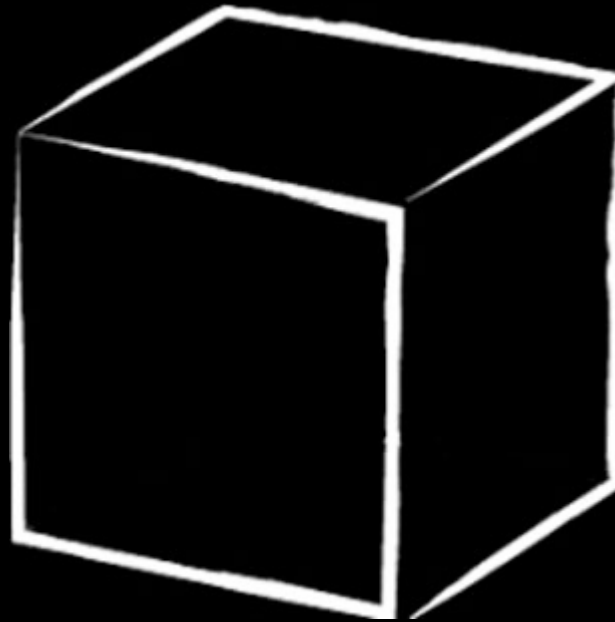




**A firefighter's language is the  
language of energy.**

**MJ, MW, HRR, Heat Flux, Pressure,  
Matter, Decomposition...**





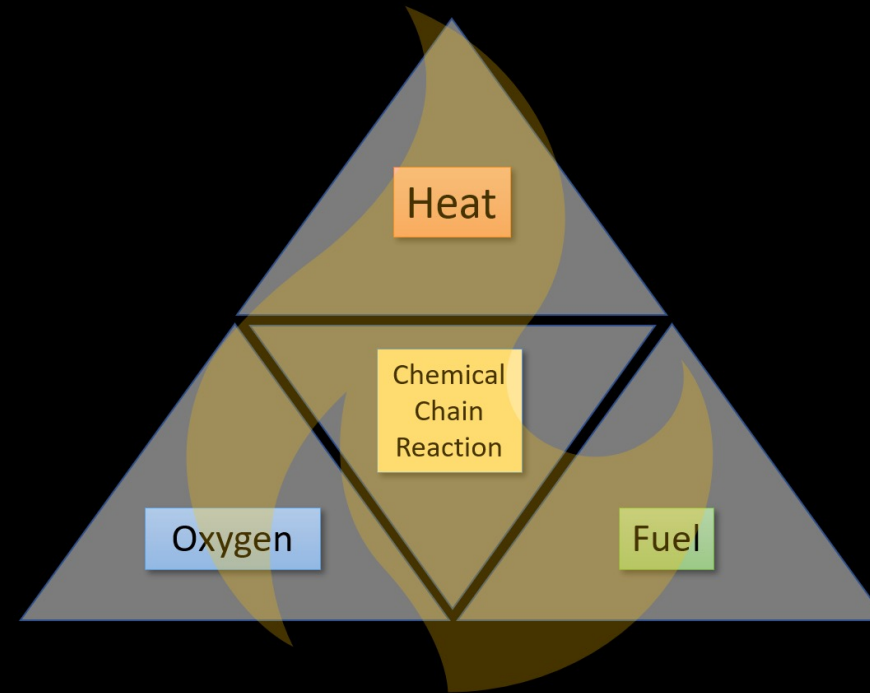
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# The Fire Triangle

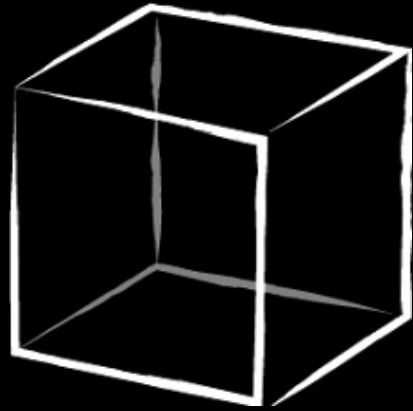


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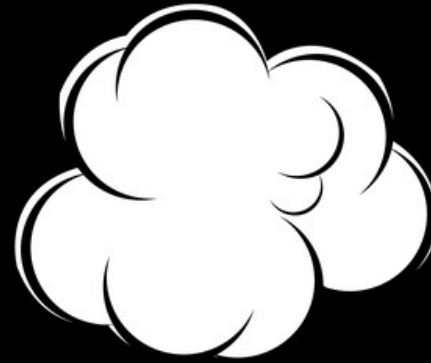
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# The Heat of Combustion



X3



Wood = 16 MJ/kg

Methane = 50 MJ/kg



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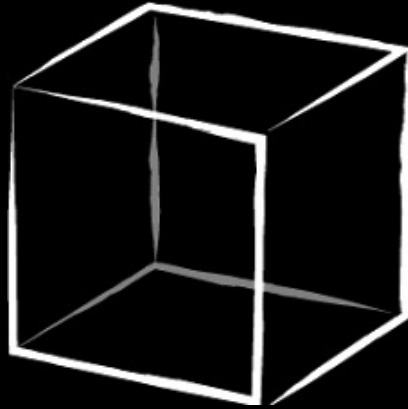




# Thornton's Rule

Each kilogram of oxygen used in the combustion of common organic materials results in release of **13.1 MJ** of energy (or approx. **3 MJ/Kg** for air).

# Thornton's Rule



=



Wood = 13.1 MJ/kg O<sub>2</sub>  
(3 MJ/Kg air)

Methane = 12.5 MJ/kg O<sub>2</sub>  
(2.9 MJ/Kg air)



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Modern fuel composition has a higher heat of combustion but, (pound for pound), uses nearly 4 times more air to liberate that energy than legacy fuels...

... and the introduction of fresh air will most likely increase HRR and the development of the fire.

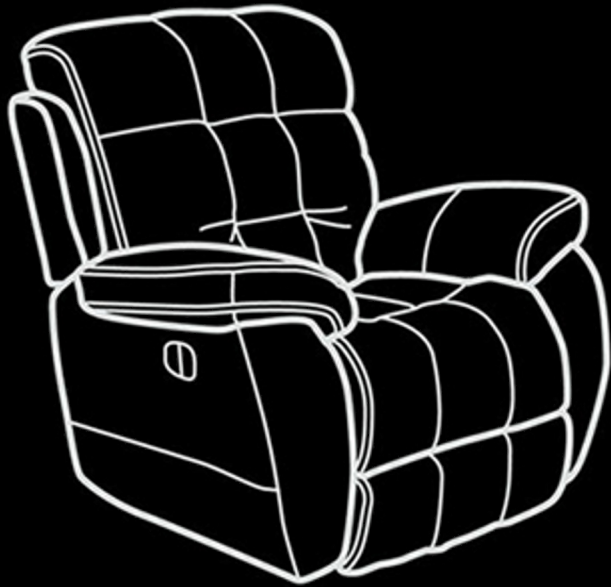


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For a standard sized room, we need just under 2 MW of energy to progress via flashover, to full involvement.



‘A standard door opening of  $2 \times 1 \text{ m}^2$  can produce a heat release rate of 4.2 MW, assuming all the oxygen is fully combusted’.

Bengtsson, 2001



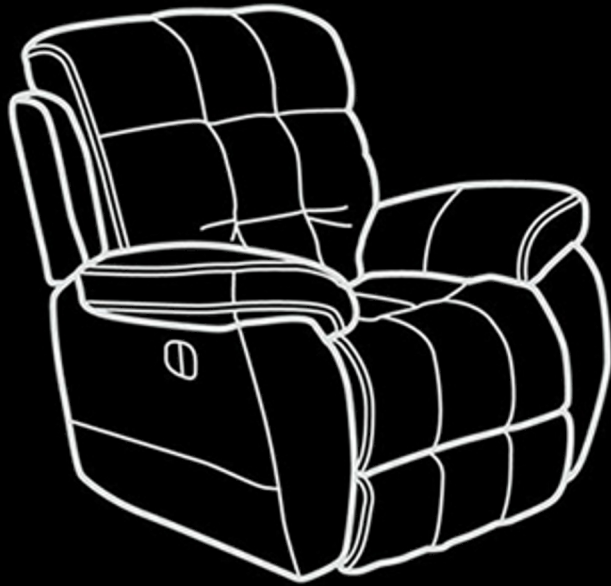
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For a standard sized room, we need just under 2 MW of energy to progress via flashover, to full involvement.



+



↑  
HRR

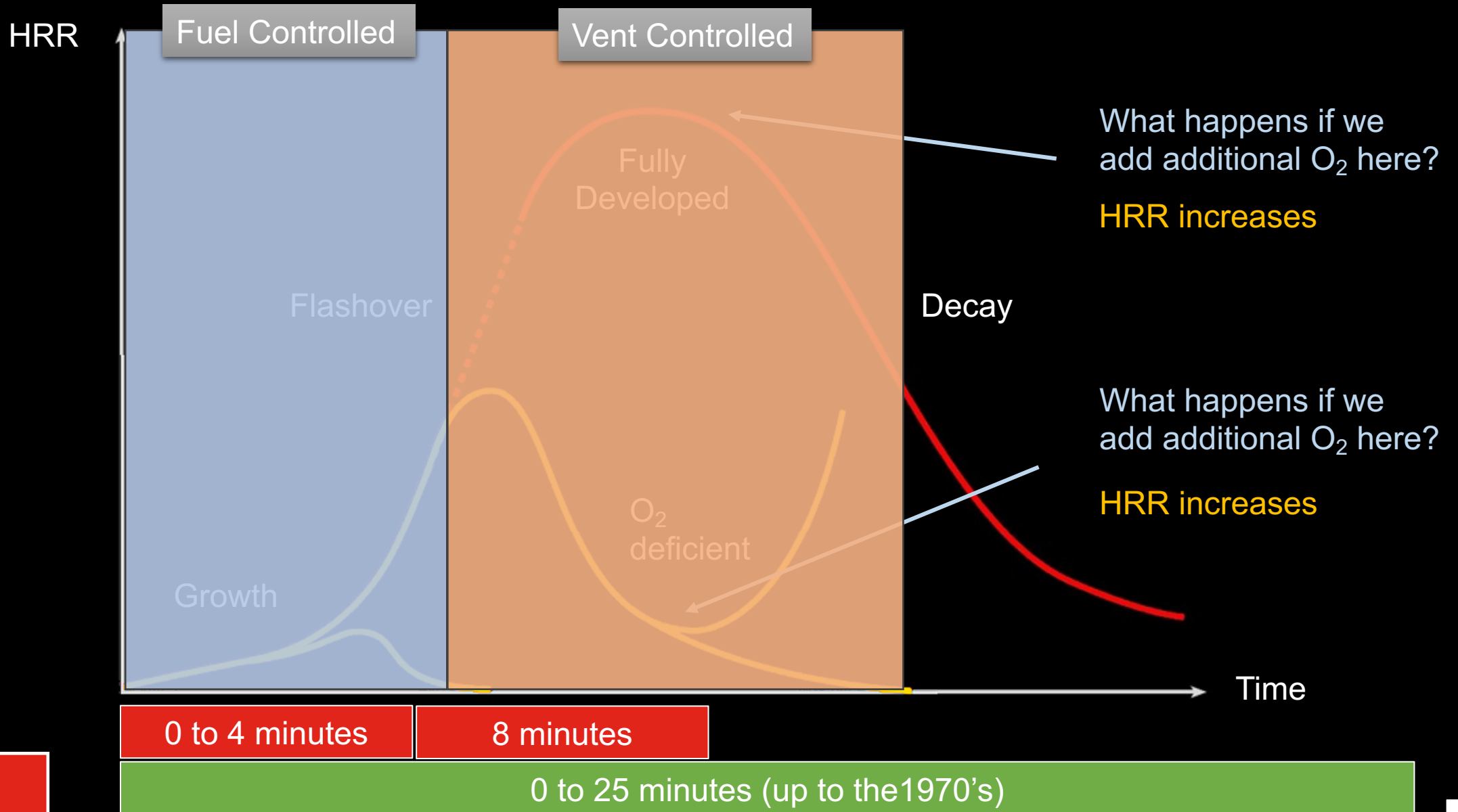
With a 'ventilation controlled fire', there is a direct relationship between an increase in HRR and an increase in air ( $O_2$ ) supply.



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Most enclosure fires will reach a stage where fire development (and HRR) is now dictated by the availability of oxygen.

Simply put, fire growth (and HRR) is limited by the available air ( $O_2$ ) supply.



Note: Both of these images show vent-controlled fires.





+00:00:00:00



Modern Bedroom

1950s Bedroom

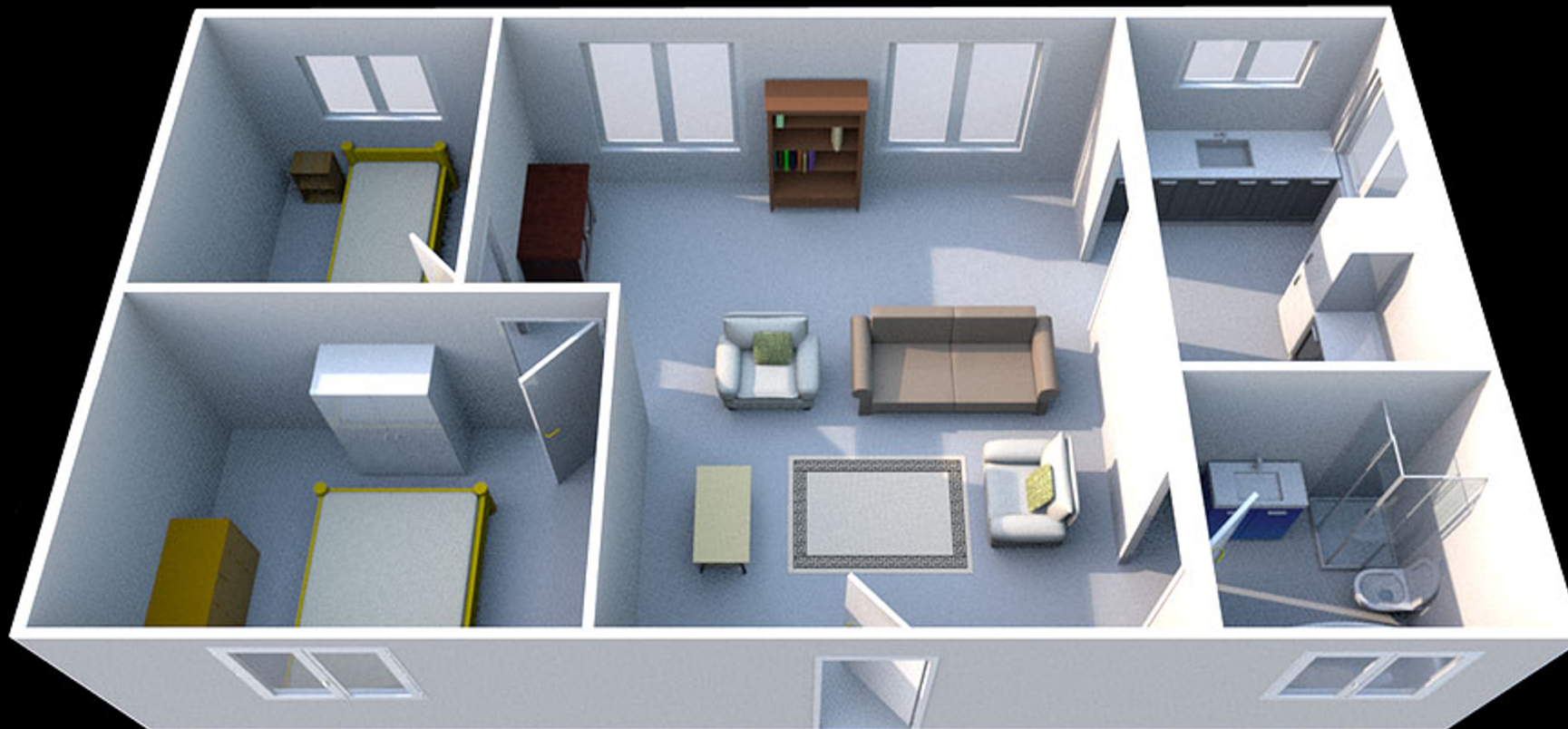


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## Acquired Structure Burn - Gilgandra



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# Acquired Structure Burn - Gilgandra



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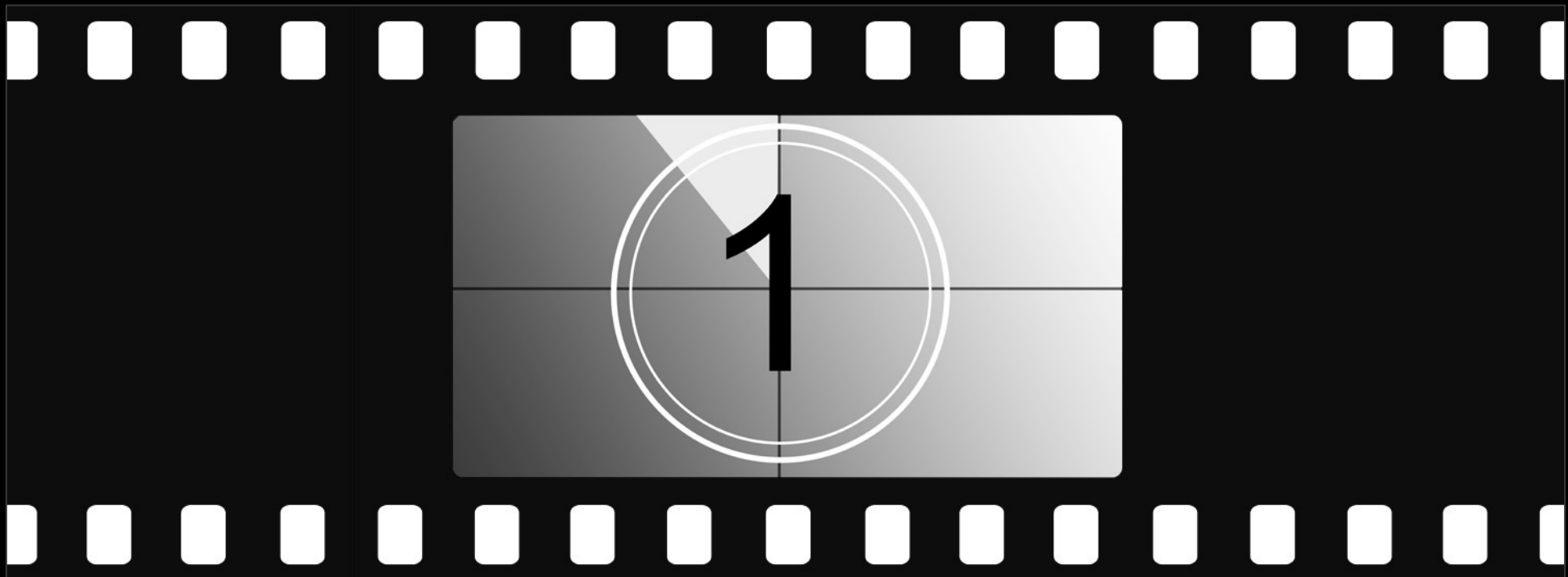




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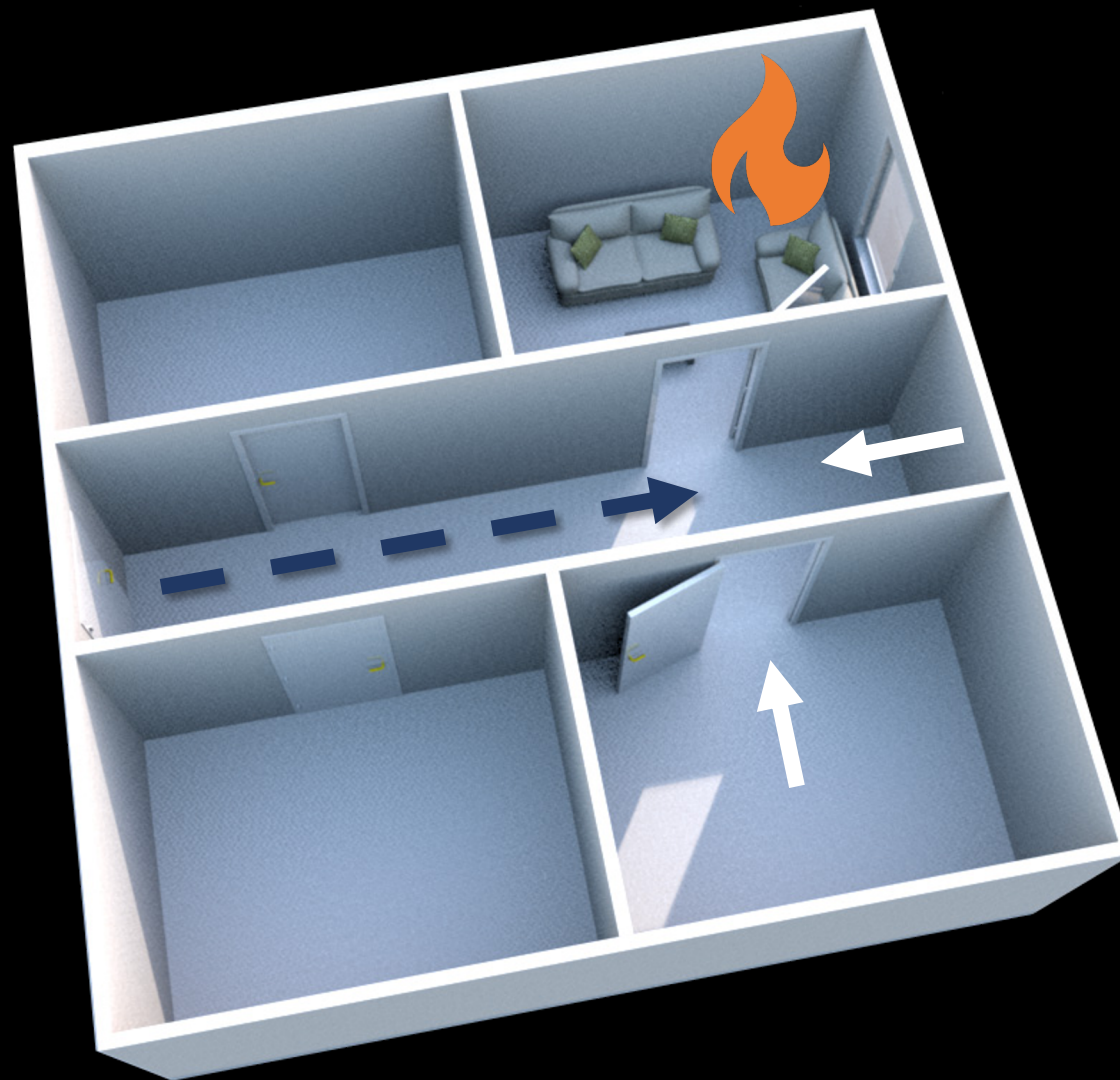




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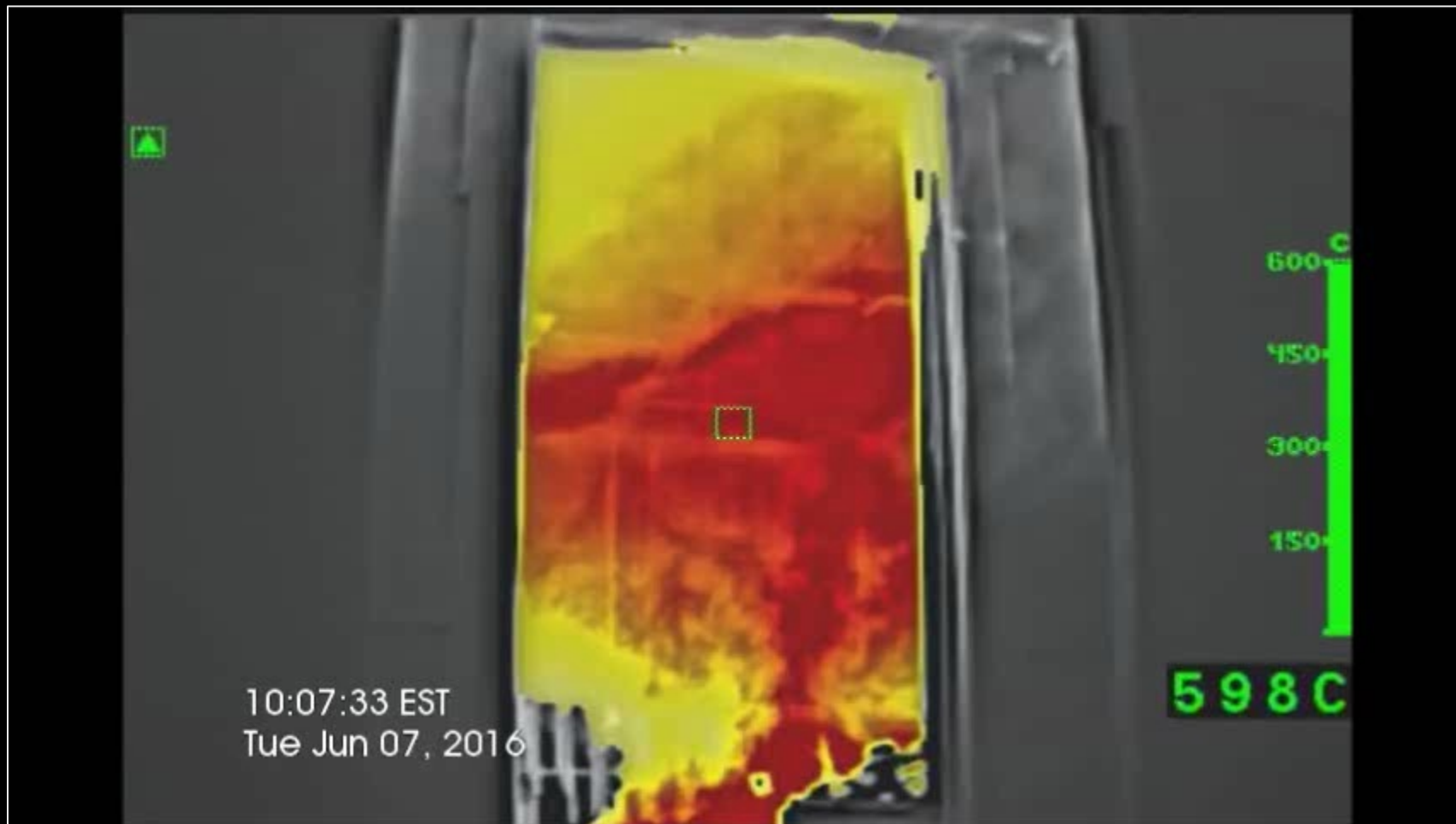


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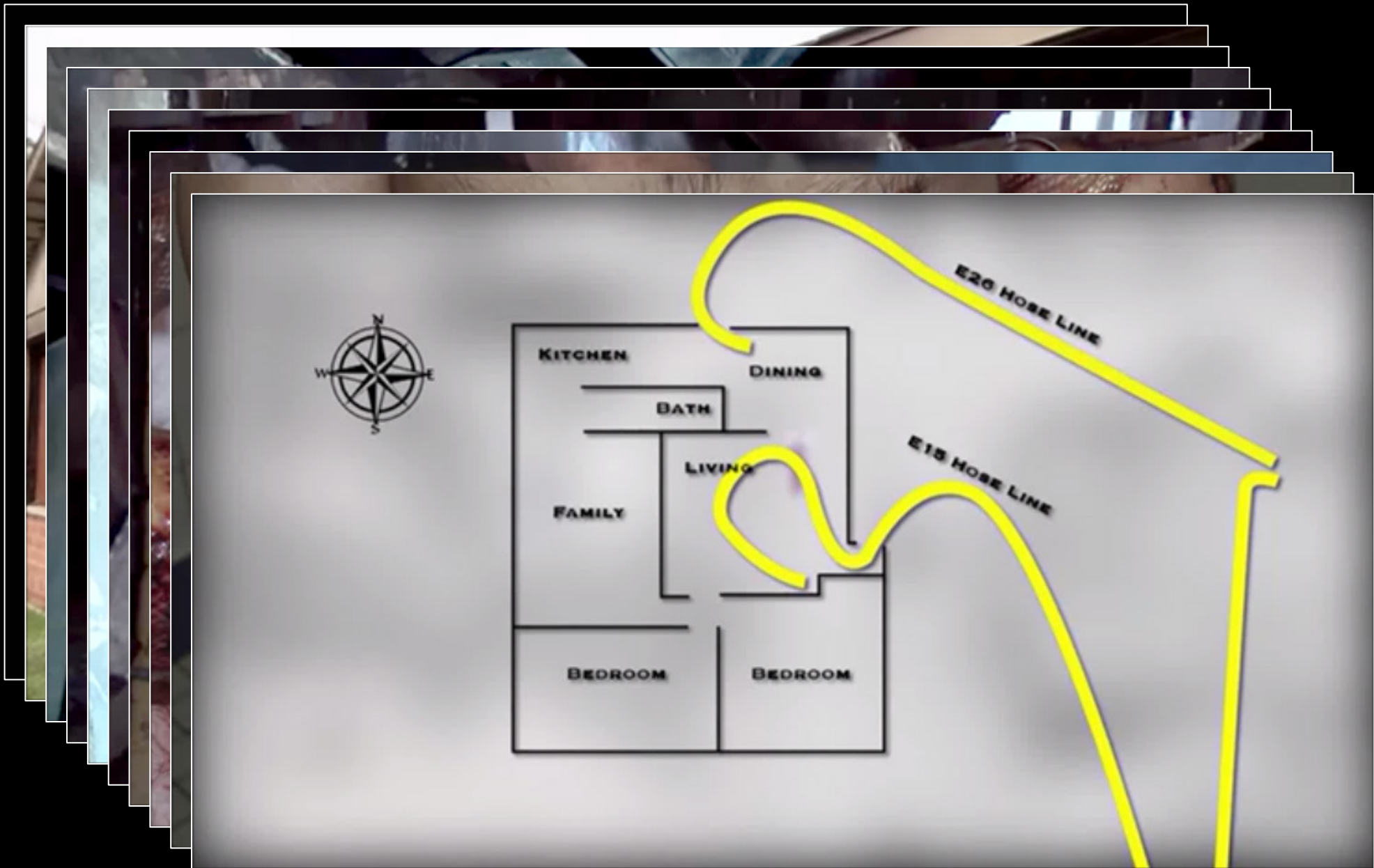




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Thank you.



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