Carbon America Making Climate Change History™

Attachment B: Construction Details

Claimed as PBI

Carbon America

(40 CFR 146.82(a))

Revision	Date	Notes	Written By	Approved By
A	03/12/2024	Issued for Approval		R. Keeling

Claimed as PBI

Contents

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Appendices

1. Facility Information

- Facility Name: Claimed as PBI
- Well Name: Claimed as PBI
- Facility Contact: Claimed as PBI
- Proposed Well Location: Claimed as PBI

2. Introduction

Claimed as PBI, detailed herein and shown in Figure B-1, is Claimed as PBI Upon approval of this Class VI permit application, Claimed as PBI The well casing design includes a conductor and surface casing string, as well as a dedicated injection casing string. Each casing string is designed for expected drilling and injection loads, and will be cemented to the surface to ensure structural integrity and zonal isolation.

Well design was conducted in-house by the Claimed as PBI reservoir engineering and geological teams, and was verified by a third-party independent engineering firm. The design process was informed by the subsurface data characterization, as discussed in Section 4 of the **Permit Application Narrative**, and the static and dynamic modeling of the subsurface as discussed in Section 2 of **Attachment A: Area of Review and Corrective Action Plan**.

Key industry standard design factors were employed in the well design, ensuring robustness and safety, and are as follows:

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Further, additional engineering design assumptions were incorporated to provide specific requirements of carbon dioxide (CO_2) injection in a Claimed as PBI and other operational parameters:

- Compliance with U.S. Environmental Protection Agency (EPA) Underground Injection Control (UIC) Class VI requirements.
- Modeling of varied CO_2 injection rates.
- Calculation of maximum allowable injection pressure (MAIP).
  - MAIP calculated for surface and bottomhole pressures (discussed further in Section 4 of this document).

For the designed completion and injection phases, premium connections will be used for the injection casing, tubing and tubing hanger, and packer. Cementing will be a critical aspect of well integrity:

- Each casing section will be cemented to the surface, verified through cement bond log (CBL) and volumetric analyses.

- Claimed as PBI

3. Injection Well Construction Details

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Table B-1 provides the planned Claimed as PBI

Table B-1. Open Hole Diameters and Intervals

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- *Surface Section:* Claimed as PBI .
- *Injection Section:* Claimed as PBI

3.1 Casing and Cementing

3.1.a Casing Design

The casing design for the Claimed as PBI injection well was meticulously developed, employing advanced casing design software to accurately model the various drilling and injection loads anticipated during operations. This design process was critical to ensure adherence to the stringent requirements of 40 CFR 146.82(a)(12), focusing on well integrity and protection of USDWs. Table B-2 summarizes the casing strings planned for use in the drilling of Claimed as PBI

Each casing point will be set within competent geological formations. This strategic placement is essential for ensuring the isolation of both shallow and deep USDWs, a key compliance aspect under 40 CFR 146.82(a)(12). The surface casing creates an effective barrier against potential fluid migration into these sensitive zones.

The downhole conditions, Claimed as PBI were integral to the casing design process. These conditions provided essential inputs for evaluating the mechanical stresses and environmental challenges that the casing strings will encounter, ensuring that the design can withstand these extremes while maintaining structural integrity.

Table B-2. Casing Specifications

Claimed as PBI	Claimed as PBI	Claimed as PBI	Claimed as PBI	Claimed as PBI	Claimed as PBI	Claimed as PBI	Claimed as PBI	Claimed as PBI	Claimed as PBI
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Notes:
(1 Claimed as PBI

ft MD KB = feet measured depth Kelly bushing
lb/ft = pound per foot
API = American Petroleum Institute
BTU/ft.hr.°F = British thermal units per foot, per hour, per degree Fahrenheit

To validate the mechanical integrity of each cemented casing string, post-casing run pressure tests will be conducted, followed by comprehensive evaluations using CBL. These tests are crucial to demonstrate the robustness of the casing design and the effectiveness of the cementing process, per the requirements of 40 CFR 146.82(a)(12), which emphasizes the maintenance of well integrity throughout the well's operational life.

Additionally, specific attention was given to the 7-inch injection string, designed to handle the maximum CO_2 injection volumes. The 7-inch string design process involved modeling both drilling and injection loads, ensuring that it could withstand the unique challenges posed by CO_2 injection operations. In line with the regulatory focus on material suitability and fluid migration prevention, Claimed as PBI was selected for cementing across the planned injection zone and upper and lower confining zones. The use of Claimed as PBI in this section underscored the commitment to ensuring long-term well integrity and adherence to the stringent environmental protection standards set forth by EPA under 40 CFR 146.82(a)(12).

3.1.b Cement Design

The cement design for the proposed Claimed as PBI injection well is crucial in fulfilling the requirements of 40 CFR 146.82(a)(12), which mandates stringent measures for well integrity and environmental protection, particularly in the context of Class VI wells used for CO_2 injection and sequestration.

Claimed as PBI

3.2 Tubing and Packer

Proposed tubing and packer specifications are listed in Tables B-3 and B-4. The downhole configuration of the tubing and packer elements is shown in Figure B-2.

Claimed as PBI , shown in Appendix B-5, Claimed as PBI

Claimed as PBI shown in Appendix B-6, Claimed as PBI

3.3 Completion Procedure

The proposed completion interval in Claimed as PBI is detailed below and is shown in Figure B-2. Note that these procedures are subject to change based on field conditions and the availability of materials. A detailed procedure will be provided to EPA prior to the completion of Claimed as PBI

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13. Claimed as PBI

Table B-3. Tubing Specifications

Notes: Claimed as PBI
ft MD KB = feet measured depth Kelly bushing
lb/ft = pound per foot
API = American Petroleum Institute
psi = pounds per square inch
lb = pounds

Table B-4. Packer Specifications

Notes: Packer specifications listed in Appendix B-6.
ft MD KB = feet measured depth Kelly bushing
lb/ft = pound per foot
lb = pounds
psi = pounds per square inch

4. Continuous Monitoring and Automatic Shutoff Devices

Claimed as PBI

alculated MAIP. The MAIP, Claimed as PBI per 40 CFR 146.88 (a), Claimed as PBI

Claimed as PBI

Any deviations from normal operating specifications, indicating a potential issue within the well (such as loss of mechanical integrity or tubing blockage) or caused by a change in injection flowrate, will be further investigated. Anomalous pressure measurements trigger the need for an investigation into the cause of the change [40 CFR 146.89 (b)].

Figures

Figure B-1

Figure B-2

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Appendix B-1
Surface Casing Specifications

Claimed as PBI [redacted]


Claimed as PBI

Appendix B-2

Claimed as PBI [redacted]

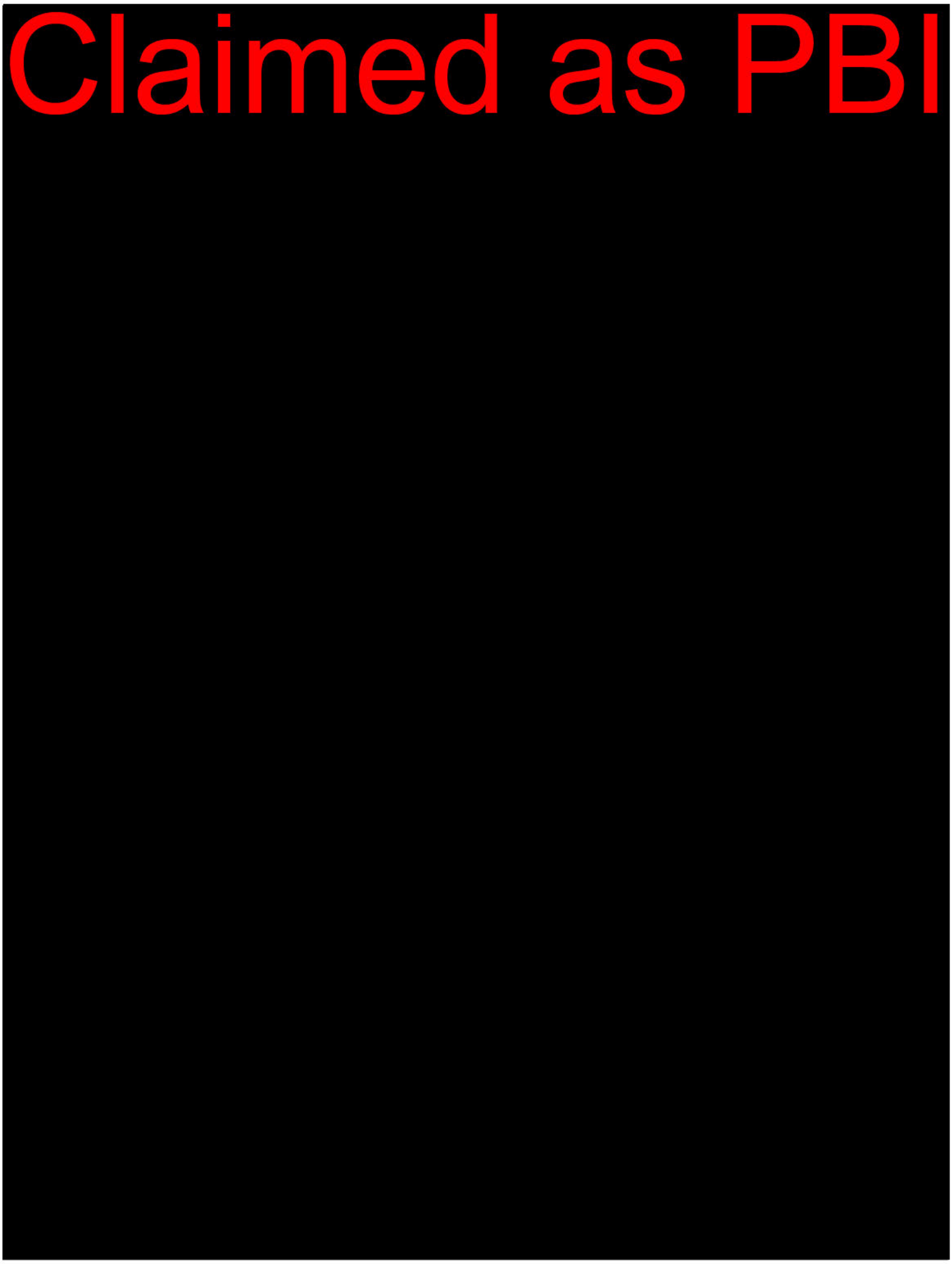
Claimed as PBI [redacted]


Claimed as PBI

Appendix B-3

Claimed as PBI [redacted]

Claimed as PBI [redacted]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Appendix B-4

Claimed as PBI [redacted]

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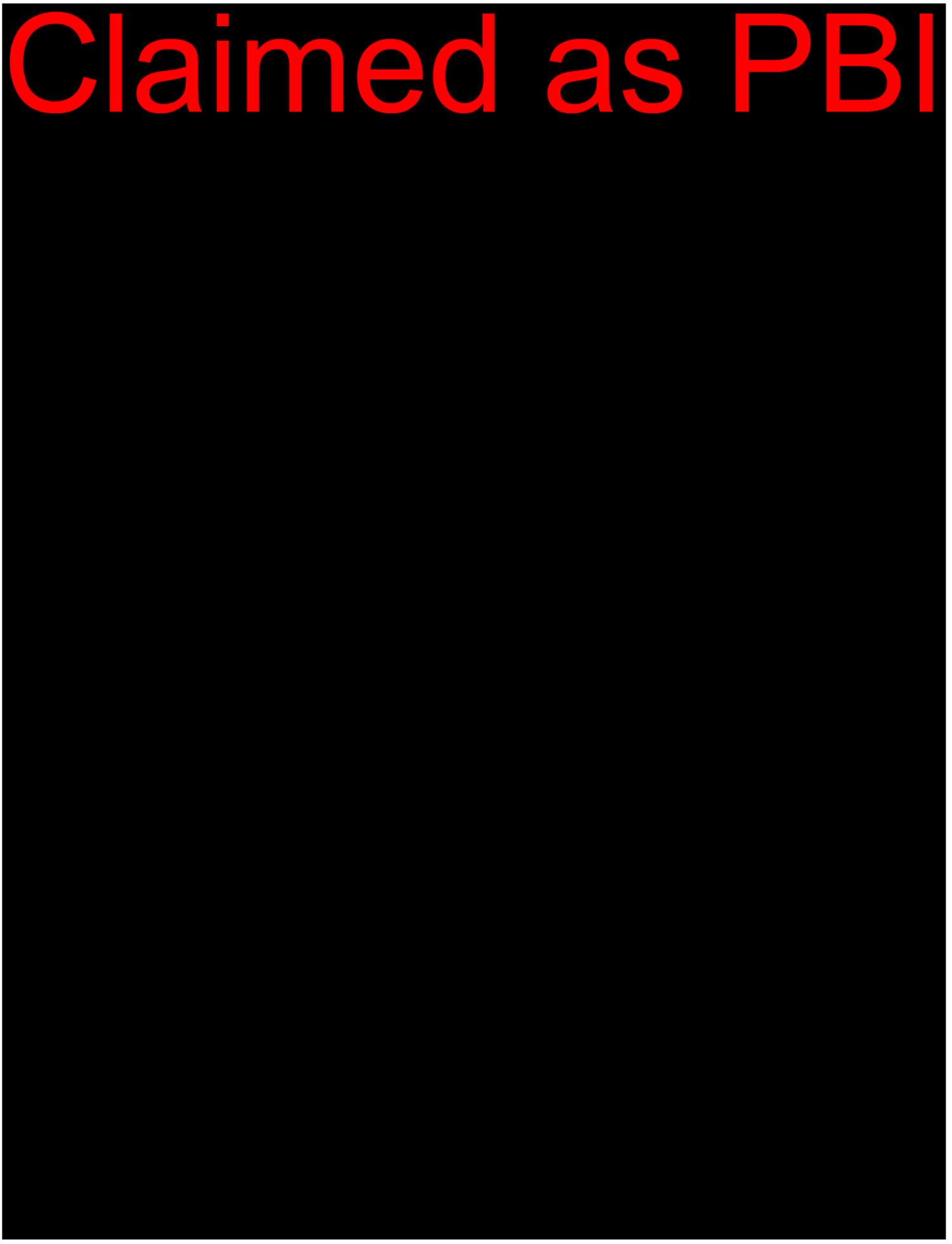
Appendix B-5

Claimed as PBI [redacted]

Claimed as PBI [redacted]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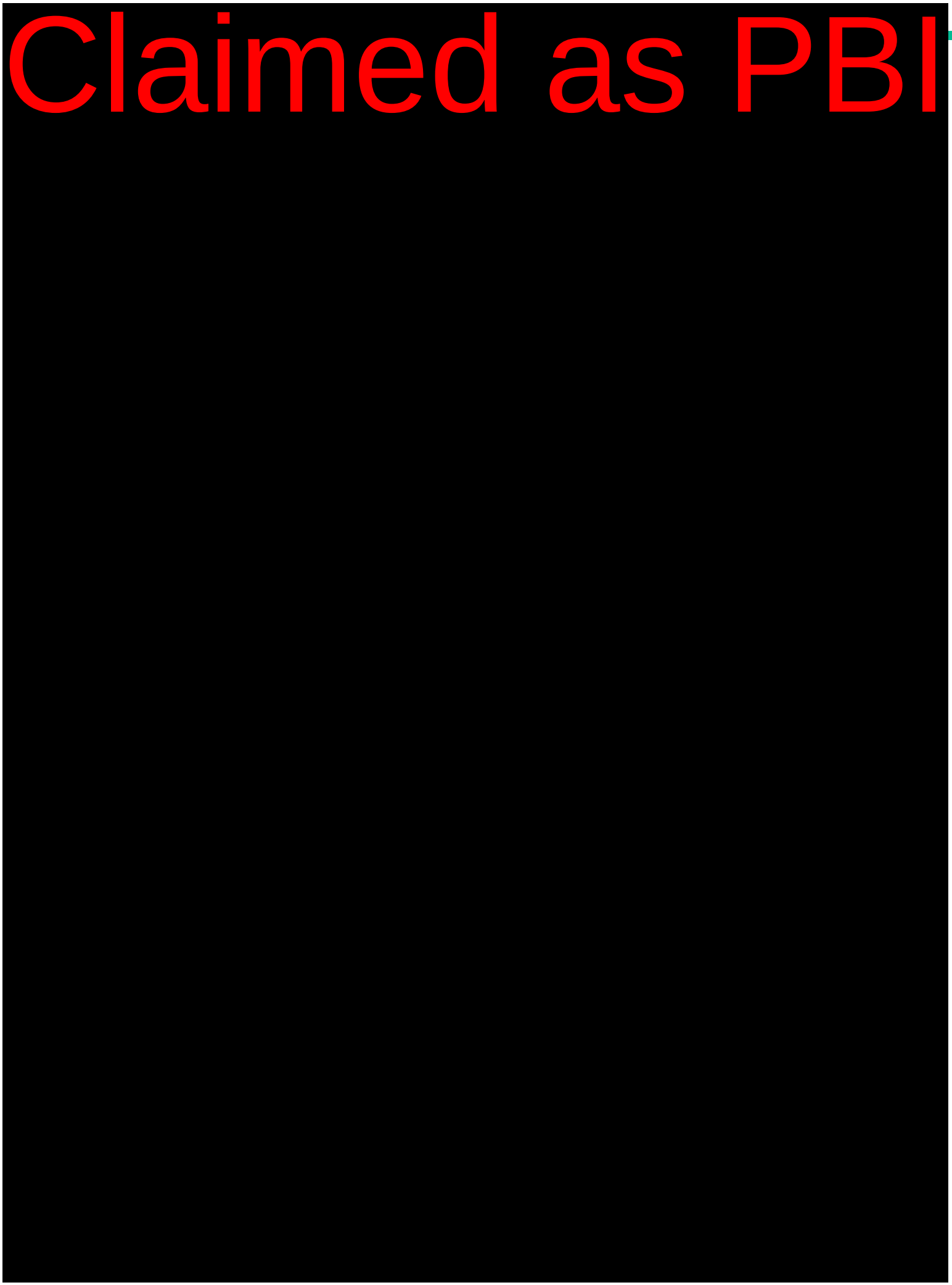
Appendix B-6
Packer Specifications

Claimed as PBI [redacted]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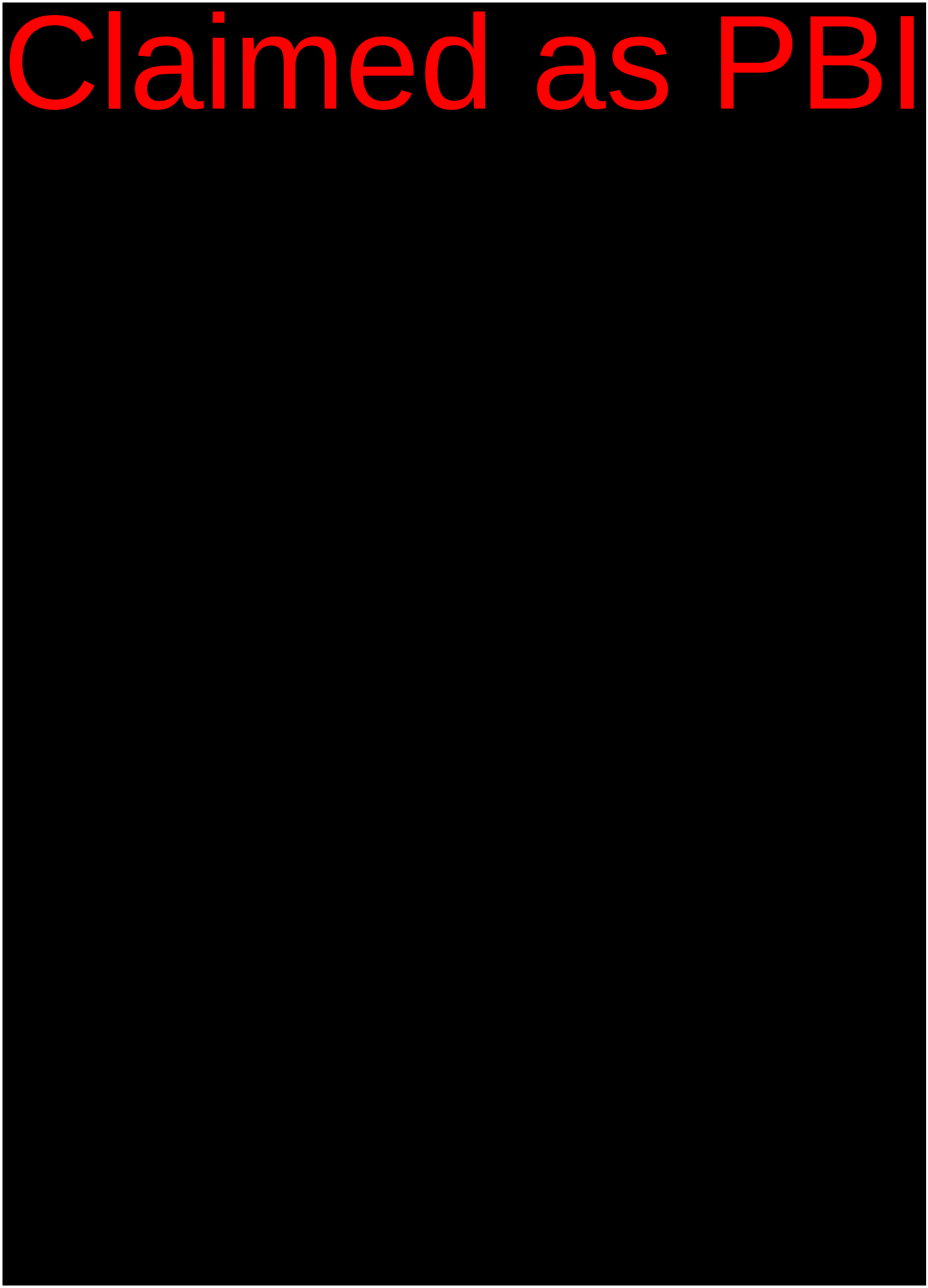
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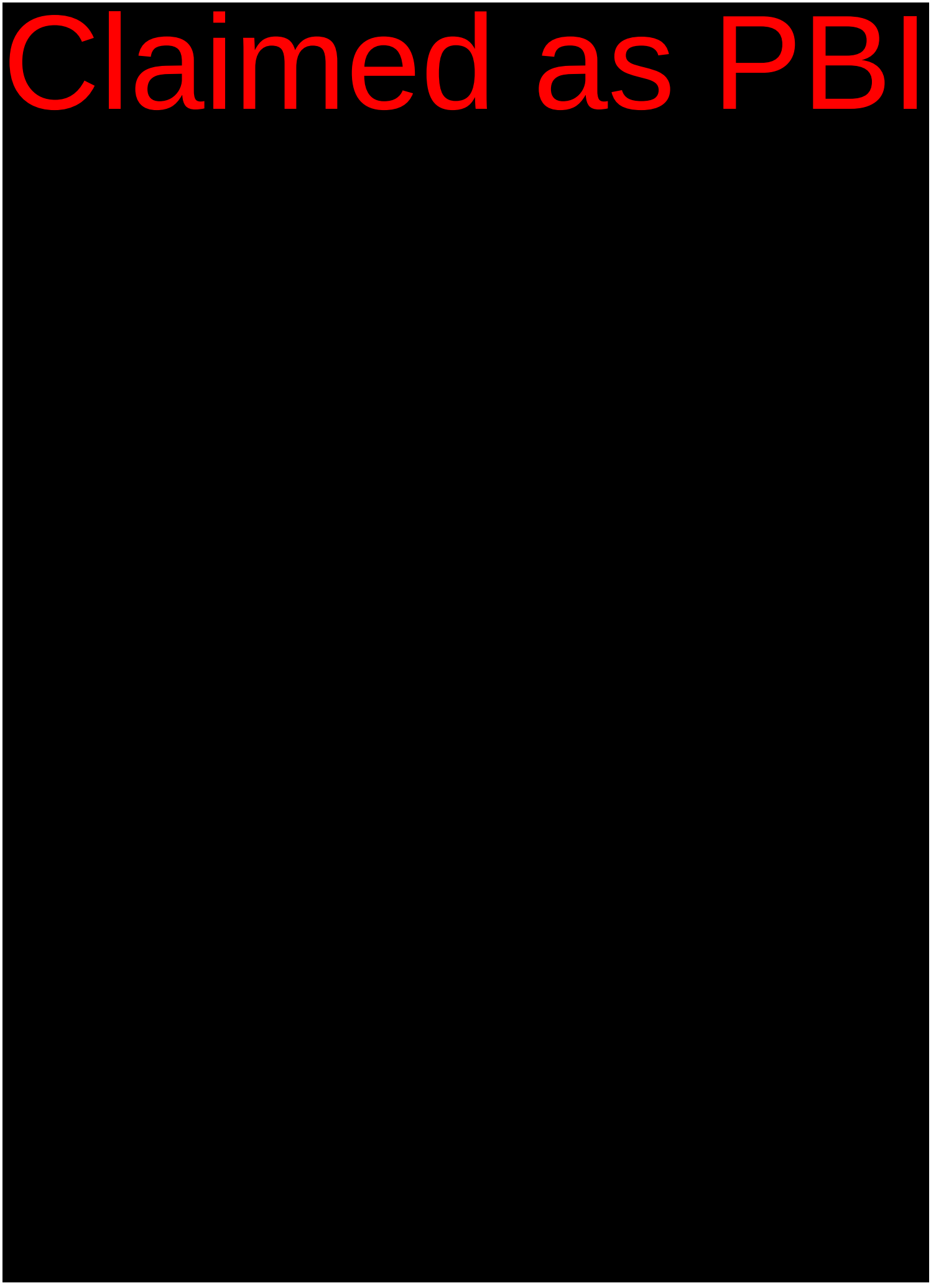
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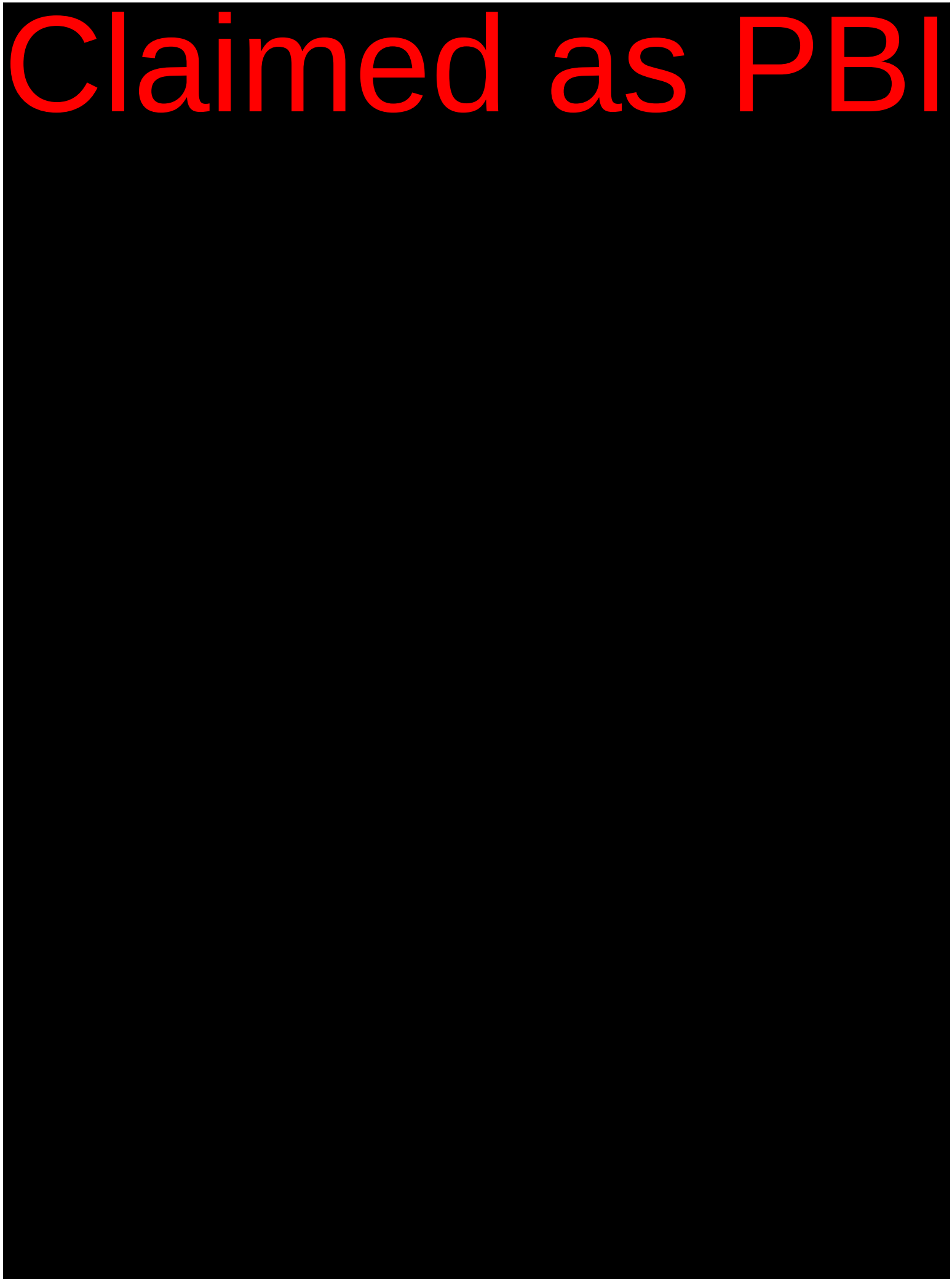
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