🛢️ Petrophysics Calculator IAM Permissions

AWS Energy Data Insights Platform | Well Log Analysis & Calculations

📋 Overview

Service Role: `PetrophysicsCalculatorRole`

Function Name: `petrophysics-calculator`

Purpose: Processes LAS files, performs petrophysical calculations (porosity, shale volume, water saturation), and generates professional analysis reports

Timeout: 60 seconds | **Memory:** 512 MB

🧱 Calculation Capabilities

📊 Porosity Calculations

Density, neutron, effective, and total porosity using industry-standard methods

🪨 Shale Volume

Larionov (tertiary/pre-tertiary), linear, and Clavier methods

💧 Water Saturation

Archie equation with configurable parameters (a, m, n, Rw)

📈 Multi-Well Correlation

Cross-well analysis and geological interpretation

✅ Data Quality Assessment

Completeness, outlier detection, and environmental corrections validation

📉 Statistical Analysis

Mean, median, std dev, percentiles for curve data

📦 S3 Permissions

`s3:GetObject` REQUIRED

Resource: `arn:aws:s3:::storage-bucket/well-data/*`

Read LAS (Log ASCII Standard) files for petrophysical analysis. LAS files contain well log curves (GR, RHOB, NPHI, RT, etc.) required for all calculations.

`s3:PutObject` OPTIONAL

Resource: `arn:aws:s3:::storage-bucket/petrophysics-results/*`

Store calculation results and generated reports. Optional if results are returned inline to chat Lambda instead of stored separately.

CloudWatch Logs Permissions

`logs:CreateLogGroup` REQUIRED

Resource: `arn:aws:logs:*:*:log-group:/aws/lambda/petrophysics-calculator:*`

Standard Lambda logging permission for CloudWatch log group creation.

`logs:CreateLogStream` REQUIRED

Resource: `arn:aws:logs:*:*:log-group:/aws/lambda/petrophysics-calculator:*`

Create log streams for each calculation request. Essential for debugging LAS file parsing and calculation errors.

`logs:PutLogEvents` REQUIRED

Resource: `arn:aws:logs:*:*:log-group:/aws/lambda/petrophysics-calculator:*`

Write calculation logs including input parameters, intermediate results, and final outputs. Critical for validating calculation accuracy.

Complete IAM Policy JSON

```
{ "Version": "2012-10-17", "Statement": [ { "Effect": "Allow", "Action": "s3:GetObject", "Resource":
"arn:aws:s3:::storage-bucket/well-data/*" }, { "Effect": "Allow", "Action": "s3:PutObject", "Resource":
"arn:aws:s3:::storage-bucket/petrophysics-results/*" }, { "Effect": "Allow", "Action": [
"logs:CreateLogGroup", "logs:CreateLogStream", "logs:PutLogEvents" ], "Resource": "arn:aws:logs:*:*:log-
group:/aws/lambda/petrophysics-calculator:*" } ] }
```

Read-Only Data Access: This Lambda only needs read access to well data. It doesn't modify source LAS files, ensuring data integrity. Write access to results directory is optional and can be removed if results are returned inline.

Calculation Workflow

1. **Invocation:** Chat Lambda invokes with calculation request (well name, curve names, method)

2. **LAS File Retrieval:** Reads LAS file from S3 using well name
3. **Data Parsing:** Parses LAS file format, extracts curve data and metadata
4. **Data Validation:** Checks for null values (-999.25, -9999), validates curve availability
5. **Calculation:** Executes requested petrophysical calculation using industry-standard formulas
6. **Quality Assessment:** Evaluates data quality and calculation confidence
7. **Response Generation:** Formats results according to SPE/API standards
8. **Return:** Returns calculation results to chat Lambda for display

📐 Industry Standards Compliance

- **SPE Standards:** Society of Petroleum Engineers calculation methodologies
- **API RP 40:** Recommended practices for core analysis
- **ISO GUM:** Guide to the expression of uncertainty in measurement
- **LAS 2.0/3.0:** Log ASCII Standard file format support

📊 Example LAS File Structure

```
~Version Information VERS. 2.0 : CWLS LOG ASCII STANDARD - VERSION 2.0 WRAP. NO : ONE LINE PER DEPTH STEP
~Well Information WELL. WELL-001 : WELL NAME FLD . PERMIAN BASIN : FIELD LOC . TEXAS : LOCATION ~Curve
Information DEPT.M : DEPTH GR .API : GAMMA RAY RHOB.G/C3 : BULK DENSITY NPHI.V/V : NEUTRON POROSITY RT .OHMM
: TRUE RESISTIVITY ~ASCII 2500.00 75.5 2.45 0.18 12.5 2500.50 78.2 2.43 0.19 11.8 ...
```