



# KASSANE GOLD MINE

## Sodium Cyanide Transport

### Risk Analysis & Cost Optimization

*Route: Accra (Ghana) > Ouagadougou > Kaya > Dori > Kassane Mine (Burkina Faso)*

56 trucks/month | 14-truck armed convoys | Insurgent-active corridor

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# 📍 TRANSPORT ROUTE OVERVIEW



## LOGISTICS PARAMETERS

Monthly volume: **56 trucks**  
Convoy size: **14 trucks / week**  
Convoy frequency: **4 convoys/month**  
Round trip duration: **up to 60 days**  
Army escort: **Kaya to Mine**  
Commodity: **Sodium Cyanide (hazmat)**

## CRITICAL CONSTRAINTS

Ouagadougou: **Night transit ban for hazmat**  
Kaya wait: **Up to 14 days for army convoy**  
Dori wait: **Up to 7 days staging**  
Security threat: **Frequent insurgent attacks**  
Free waiting: **Only 2 days per truck**  
Waiting cost: **\$200/day/truck (after free days)**



## WAITING COST CALCULATION — METHODOLOGY

**Step-by-step cost buildup for each truck (worst-case scenario):**

**STEP 1 — Maximum waiting days per trip**

Kaya wait (army convoy): up to 14 days + Dori wait (staging): up to 7 days = 21 total waiting days

**STEP 2 — Deduct free waiting days**

Trucking companies provide 2 free waiting days per trip (included in the freight rate).

**Billable waiting days per truck per trip: 21 - 2 = 19 days**

**STEP 3 — Cost per truck per trip**

**19 billable days x \$200/day = \$3,800 per truck per trip**

**STEP 4 — What does \$200/day cover?**

Driver meals & accommodation | Satellite phone usage (convoy leaders) | Private security guards

*NOTE: No additional fees during transit legs (Accra > Paga > Ouaga > Kaya, and Dori > Mine).*

# \$ MONTHLY & ANNUAL COST IMPACT

PER TRUCK  
PER TRIP

**\$3,800**

19 days x \$200/day

MONTHLY  
(56 TRUCKS)

**\$212,800**

56 trucks x \$3,800

ANNUAL  
(12 MONTHS)

**\$2.55M**

$\$212,800 \times 12 \text{ months}$

## SCENARIO ANALYSIS — IMPACT OF WAITING DURATION

Scenario	Kaya Wait	Dori Wait	Total Wait	Billable Days	Cost/Truck	Monthly (56)	Annual
Best Case	3 days	1 day	4 days	2	\$400	\$22,400	\$268,800
Moderate	7 days	3 days	10 days	8	\$1,600	\$89,600	\$1,075,200
Likely	10 days	5 days	15 days	13	\$2,600	\$145,600	\$1,747,200
Worst Case	14 days	7 days	21 days	19	\$3,800	\$212,800	\$2,553,600



# RISK REGISTER – SECURITY & OPERATIONAL

ID	Risk	Likelihood	Impact	Rating	Consequence
R1	Insurgent ambush on Kaya-Dori-Mine corridor	High	Critical	EXTREME	Loss of life, cargo theft, route closure, environmental spill of NaCN
R2	Extended army convoy delays (>14 days)	Medium	High	HIGH	Demurrage costs escalate, NaCN supply disruption to mine, production halt
R3	NaCN spill or leak during attack or accident	Medium	Critical	EXTREME	Environmental contamination, fatalities, regulatory shutdown, community backlash
R4	Road deterioration / impassable route (rainy season)	Medium	High	HIGH	Multi-week delays, truck damage, additional costs, stranded cargo
R5	Border delays at Paga (customs, paperwork)	Medium	Medium	MEDIUM	1-3 day delays per crossing, cascading convoy scheduling issues
R6	Driver fatigue / accident (60-day round trip)	Medium	High	HIGH	Injuries, NaCN spill, truck loss, insurance claims, replacement costs



# RISK REGISTER – FINANCIAL & SUPPLY CHAIN

ID	Risk	Likelihood	Impact	Rating	Consequence
R7	Demurrage cost overruns (>\$2.5M/yr)	High	High	HIGH	Budget blow-out, reduced mine profitability, pressure on AISC
R8	Trucking company refuses/abandons route	Medium	Critical	EXTREME	Complete supply chain failure, no alternative carrier, production stops
R9	Fuel price spikes or scarcity on route	Medium	Medium	MEDIUM	Higher freight rates, stranded trucks, renegotiation of contracts
R10	Political instability / coup / route closure	Medium	Critical	EXTREME	Indefinite supply disruption, asset stranding, force majeure
R11	NaCN regulatory ban or restriction change	Low	High	MEDIUM	Need for alternative reagent or new permits, supply gap
R12	Community blockade at mine or en route	Medium	Medium	MEDIUM	Convoy held up, negotiation delays, reputational damage

# 📊 RISK HEAT MAP





# MITIGATION MEASURES – COST REDUCTION

## NEGOTIATE DEMURRAGE TERMS

- Increase free days from 2 to 5 per trip in contract renegotiation
- Savings: 3 extra free days x \$200 x 56 trucks = \$33,600/mo (\$403,200/yr)
- Negotiate tiered rates: \$150/day after day 5, \$200 after day 10
- Include demurrage cap clause (max billable days per trip)
- Bundle annual volume commitment for better rates

## OPTIMIZE CONVOY SCHEDULING

- Coordinate with army to establish fixed weekly convoy schedule from Kaya
- Target: reduce Kaya wait from 14 to 5-7 days average
- Pre-position trucks at Kaya to match army departure dates
- Establish direct liaison officer with military command
- Share convoy costs with other mines on the same route

## BUILD STRATEGIC NaCN BUFFER

- Maintain 45-60 day NaCN inventory at mine site
- Decouple mine operations from transport disruptions
- Send fewer but larger convoys (reduce frequency risk)
- Explore pre-positioning NaCN at Dori staging area
- Reduces urgency premium and emergency shipment costs



# MITIGATION MEASURES – SECURITY & OPERATIONS

## ENHANCED SECURITY FRAMEWORK

- GPS tracking on all trucks with real-time monitoring center
- Armored lead/tail vehicles with trained response teams
- Route intelligence sharing with MINUSMA/G5 Sahel forces
- Decoy convoy tactics and variable departure schedules
- Emergency response plan with medevac capability
- Community engagement along route (early warning network)

## ALTERNATIVE ROUTE PLANNING

- Map secondary route via Togo-Burkina corridor as backup
- Assess rail feasibility Accra to Ouagadougou (future)
- Explore air charter for emergency NaCN resupply
- Pre-negotiate permits for Ivory Coast transit route
- Seasonal route switching to avoid worst road conditions
- Establish mutual aid agreements with neighboring mines

## OPERATIONAL EXCELLENCE

- Driver rotation program — max 30 days per driver per trip cycle
- Mandatory rest stops and fatigue monitoring technology
- Spill containment kits and NaCN emergency training for all drivers
- Preventive truck maintenance at Kaya (use wait time productively)
- Digital convoy management platform (ETA tracking, status updates)
- Insurance review: adequate coverage for NaCN hazmat transport

# \$ POTENTIAL SAVINGS – MITIGATION IMPACT

## CURRENT STATE (Worst Case)

Billable days/truck: **19 days**  
Monthly cost: **\$212,800**  
Annual cost: **\$2,553,600**

## TARGET STATE (With Mitigations)

Billable days/truck: **5 days (from ~8 wait, minus 3 extra free)**  
Monthly cost: **\$56,000**  
Annual cost: **\$672,000**

**POTENTIAL ANNUAL SAVINGS:  
\$1,881,600 (74% reduction)**

*Savings breakdown: Convoy optimization (~\$1.0M) + Extra free days (~\$400K) + Tiered rate negotiation (~\$480K)*



# RECOMMENDATIONS & NEXT STEPS

## IMMEDIATE ACTIONS (0-3 Months)

1. Renegotiate demurrage terms: target 5 free days and tiered daily rates.
2. Establish dedicated military liaison for fixed weekly convoy schedules from Kaya.
3. Install GPS/satellite tracking on all 56 trucks and build a monitoring dashboard.

## SHORT-TERM (3-6 Months)

4. Build strategic NaCN buffer (45-60 days) at mine to absorb disruptions.
5. Develop alternative route contingency plan through Togo-Burkina corridor.
6. Implement driver rotation and fatigue management program.

## MEDIUM-TERM (6-12 Months)

7. Evaluate consortium convoy model with neighboring mines to share costs.
8. Conduct full tender for transport services — leverage \$2.5M+ spend for competitive bids.
9. Assess rail/intermodal options for long-term cost structure improvement.