Persian Nevisa International

PNI Ecosafe - 98

ROCK-ORE LEACHING APPLICATION MANUAL

Operating guidance for heap, vat and CIP/CIL leaching

Private-label owner and commercial supplier: Persian Nevisa International

Technical Manual 2026 | Project-specific metallurgical testwork is required before scale-up

1. Scope and Operating Basis

PNI Ecosafe - 98 is a private-label, alkaline, multi-component reagent intended for precious-metal extraction from suitable ore and selected secondary feedstocks. This manual focuses on rock-ore leaching by heap, vat and agitated-tank (CIP/CIL) methods.

Private-label owner: Persian Nevisa International (PNI). **Leadership:** CEO - Mr. Shahriar Mehdizadeh.

The parameters below are operating guidelines derived from supplied source instructions. Ore mineralogy, particle size, oxygen transfer, solution chemistry and site configuration strongly affect consumption and recovery. Representative laboratory and pilot testing is mandatory before commercial deployment.

Initial operating sequence

- Prepare the heap, vat or CIP/CIL circuit, including solution tanks, pumps, piping, distribution system and recovery circuit.
- Fill the solution preparation tank with measured fresh water.
- Add lime (CaO) or caustic soda (NaOH) under circulation to raise pH to 10.5-11.5. For rock-ore leaching, maintain approximately pH 11.0-11.5.
- Condition the alkaline solution for approximately 3-4 hours before adding reagent, where practical.
- Add PNI Ecosafe - 98 progressively under circulation until completely dissolved.
- Transfer the prepared solution to the leaching circuit and monitor pH, reagent concentration, dissolved oxygen and pregnant-solution grade.

Key preliminary dosage references

Ore / operating condition	Indicative starting concentration
Common oxide, semi-oxide, quartz-vein and readily leacha	0.5-1.5 kg PNI Ecosafe - 98 per tonne of water
Sulfide-dominant or multi-metal ores	2-5 kg/t water; testwork required due to competing reactions
Existing cyanidation operation	Existing NaCN concentration may be used only as an initial reference; confirm compatibility ar

2. Applications, Product Form and Chemistry

Typical applications

- Rock-ore leaching for suitable oxide, sulfide, silver-bearing and selected PGM-bearing ores.
- Selected electronic-waste precious-metal recovery.
- Selected automotive-catalyst, solar-panel and pulverized electronic-component applications using appropriately designed equipment.

Physical appearance

Light-grey to light-brown granules or powder. Shade may vary between batches. A weak ammonia-like odour may be present.

Indicative temperature range

- Rock-ore leaching: ambient solution temperature preferably above 15 degrees C.
- Selected e-waste stripping applications: approximately 35-45 degrees C may improve performance, subject to process validation.

Leaching chemistry - technical context

The source formulation is described as a fused multi-component chemical blend manufactured at high temperature. Multiple complexing species may participate in precious-metal dissolution. The following reactions are presented as possible source mechanisms and are not a complete formulation disclosure:

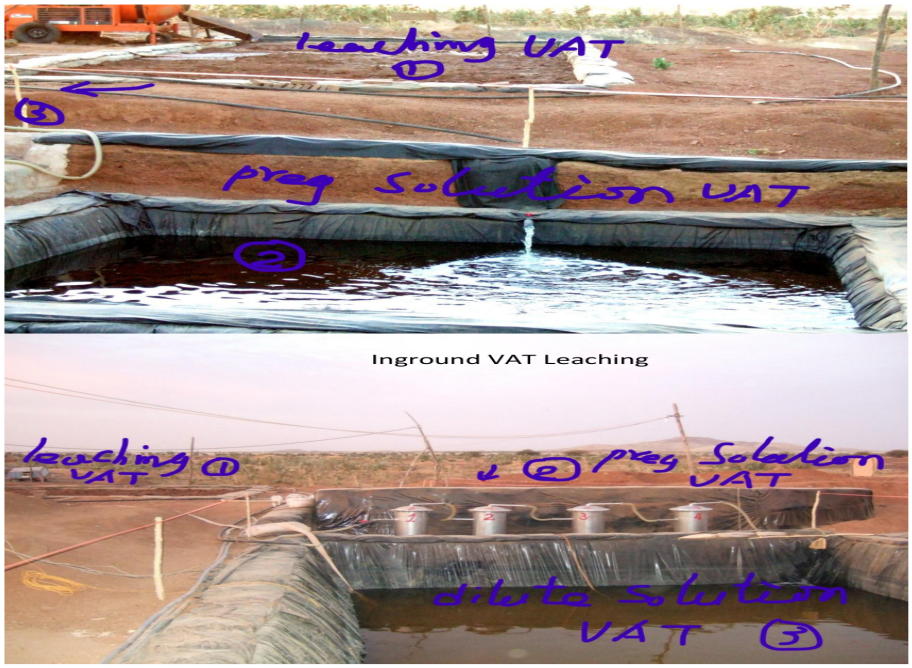
Illustrative reaction
4Au + 4CS(NH2)2 + S2O8(2-) -> 4Au[CS(NH2)2](2+) + 2SO4(2-)
4Au + 4CS(NH2)2 + 2H2O + O2 -> 4Au[CS(NH2)2](2+) + 4OH(-)
Au + 4NH3 -> Au(NH3)4(3+) + 3e(-)
6Au + 4[Fe(CN)6](3-) + O2 + 2H2O -> 6[Au(CN)4](3-) + 4Fe(3+) + 4OH(-) + 2e(-)

Reaction pathways and actual species depend on pH, oxidation conditions, ore mineralogy and formulation. Independent metallurgical confirmation is required.

3. Applicable Leaching Methods and pH Control

Compatible process configurations

Method	Typical configuration	Operating note
Heap leaching	Solution distribution over prepared heap; collection and recirculation of pregnant solution	Long contact time; solution distribution and permeability are critical
Vat leaching	Batch or semi-batch ore bed submerged or irrigated in tanks	Maintain solution above ore surface; control short-circuiting and drainage
Agitated-tank leaching (CIP/CIL)	Slurry leaching in mechanically agitated tanks with carbon transfer and recovery	Oxygen supply, slurry density, and carbon management are key controls



Solution pH control

PNI Ecosafe - 98 solution is alkaline. In most gold/silver ore applications, acid-generating minerals may reduce pH during leaching. Adjust and maintain the solution at approximately pH 11.0-11.5 using lime or NaOH. Avoid excessive lime dosing above approximately pH 12 because scale formation on particle surfaces may hinder leaching.

Use a calibrated digital pH meter for process control. pH paper may be used only for rapid indicative checks.

4. Leaching Time and Operational Performance

Indicative source residence times

Application / method	Indicative time
Vat leaching - rock ore	Approximately 3-4 days per batch
Agitated-tank leaching - rock ore	Approximately 12-25 hours retention time
Heap leaching - rock ore	Approximately 2-3 weeks
Selected PCB / connector stripping with dedicated equipment	Approximately 6-9 minutes per batch
Pulverized IC chips, catalysts or solar-panel feed in agitation	Approximately 15-20 minutes

These values are not performance guarantees. Residence time varies with ore type, liberation, particle size, solution chemistry, temperature, oxygen availability, mass transfer and target residue grade. Determine the actual endpoint by metallurgical testwork and operating data.

Leaching rate versus overall recovery

Leaching rate is the percentage of contained metal transferred from feed solids into solution. **Overall recovery** includes all downstream losses during adsorption, precipitation, electrowinning, refining and solution management. These values are not interchangeable.

Typical source leaching-rate ranges

Method	Indicative source range
Heap leaching	75-85%
Vat leaching	85-90%
Agitated-tank leaching	90-99%

Economic optimization should target the best return at a reasonable residence time and reagent consumption, rather than an unsupported objective of 100% extraction.

5. Reagent Concentration and Testwork Program

A commercial operating concentration must be established through a structured metallurgical test program. Excess reagent increases cost and may increase oxygen demand; insufficient reagent may extend leaching time and leave recoverable metal in the residue.

Minimum testwork outputs

- Optimum PNI Ecosafe - 98 concentration, expressed as kg reagent per tonne or cubic metre of solution.
- Optimum residence time and solution-contact method.
- Optimum grind or crush size and degree of precious-metal liberation.
- Expected leaching rate and overall recovery under the selected recovery route.
- Reagent-consumption profile over time and required make-up addition.
- Solution pH, dissolved oxygen, redox potential, impurity loading and tailings characteristics.

Indicative starting ranges

Feed characteristic	Suggested test range
Readily leachable oxide/semi-oxide ore, 3-8 g/t Au	0.5-1.5 kg/t water
Multi-metal feed containing Au and Ag	Evaluate higher concentration; do not simply double dosage without test confirmation
Sulfide-dominant ore	2-5 kg/t water
Existing cyanide circuit	Use the current cyanide concentration only as an initial benchmark; verify reaction compatibility

Do not introduce PNI Ecosafe - 98 into an existing cyanide-bearing circuit without a site-specific chemical compatibility assessment, controlled

6. Gold Recovery, Solution Management and Storage

Recovery from pregnant solution

- Activated carbon or suitable resin adsorption.
- Zinc cementation, subject to solution chemistry and clarification requirements.
- Direct electrowinning for selected high-grade concentrates or process solutions.

Solution colour and insoluble solids

Depending on formulation and feed chemistry, the solution may be colourless, grey, orange or brown. Minor dark ferric solids formed during manufacturing may be present and may remain insoluble. Their process effect must be checked during testwork; unnecessary filtration should not be assumed.

Closed-loop solution management

Heap, vat and agitated-tank circuits should normally operate with collection and recirculation of leach solution. Theoretically, no untreated leach solution should be discharged. Where shutdown or final disposal is required, treatment may include controlled oxidation using calcium hypochlorite, subject to laboratory validation and local environmental regulations.

Storage and shelf life

- Store in a dry, cool and well-ventilated area.
- Keep containers tightly closed and protect from moisture, acids and food products.
- Source guidance indicates a maximum storage period of approximately two years; verify batch-specific shelf life and certificate of analysis.

Personal protection

- Use dust mask or suitable respirator, protective gloves, eye protection and long-sleeved clothing during handling.
- Provide eyewash, washing facilities and spill-control materials at the work area.
- Follow the current approved SDS and site chemical-management procedure.

7. Toxicity Context and HSE Controls

The supplied AGAT source certificate reports rainbow-trout LC50-96h = 0.793 mg/L, equivalent to 793 micrograms/L. Source documents also report differing oral rat LD50 values. The final approved SDS and jurisdiction-specific classification must be used for regulatory purposes.

Chemical	Rainbow trout LC50 (micrograms/L)	Oral rat LD50 (mg/kg)
Cyanide	28	4.3-15
CuSO4.2H2O	750	482
ZnCl2	550	329
PNI Ecosafe - 98 - source data	793	485-584*
HgCl2	84.5 (48 h)	-

*The source documents contain differing values; regulatory claims require a final certified value. Lower toxicity than cyanide does not mean non-hazardous.

Mandatory site controls

- Fence and control access to vats, ponds, tanks and solution channels.
- Prevent animals, children and unauthorized personnel from contacting process water or tailings.
- Maintain spill containment, emergency response, signage and worker training.
- Comply with local wastewater, tailings, transport, occupational-health and chemical-registration requirements.

The product must never be used, stored or disposed of without the current SDS, approved operating procedure and responsible HSE supervision.

Appendix I - Titration Equipment and Reagent Preparation

Equipment and laboratory reagents

Item	Quantity / specification
Conical flask	50 mL - 1
Brown volumetric flask	1,000 mL - 1
Brown volumetric flask	100 mL - 1
Burette	20 mL or suitable equivalent - 1
Pipette	10 mL - 1
Rubber-bulb dropper	1
Complexing solution A	1.7332 g laboratory-grade AgNO3 diluted to 1,000 mL with distilled water
Indicator solution B	0.1 g rhodanine diluted to 100 mL with acetone (>98%) or 95% alcohol

Preparation of solution A

Transfer the accurately weighed AgNO3 into the 1,000 mL brown volumetric flask. Add distilled water gradually and dissolve completely. Make up to the calibration mark, cap securely, mix gently and store protected from direct light.

Preparation of indicator solution B

Transfer 0.1 g rhodanine into the 100 mL brown volumetric flask. Add acetone of greater than 98% purity, or 95% alcohol, to the calibration mark. Cap, mix and store in a shaded cabinet.

Use appropriate laboratory PPE and chemical-handling controls. Silver nitrate, acetone and alcohol have their own hazards and must be handled under their respective SDS requirements.

Appendix I - Titration Procedure and Calculation

Titration procedure

- Pipette 10 mL of representative leach solution into a clean conical flask.
- Add 2-4 drops of indicator solution B and swirl gently.
- Fill the burette with complexing solution A, remove air from the tip and record the starting reading.
- Add solution A slowly while swirling. Near the endpoint, add dropwise.
- Stop when a stable light-pink colour remains after swirling. Record the final burette reading.

Concentration calculation

Parameter	Formula / example
Solution A consumed	Final reading - initial reading (mL)
Effective PNI Ecosafe - 98 concentration	Solution A consumed (mL) / 2 = concentration in per mille
Example	4.8 mL / 2 = 2.4 per mille

Make-up reagent calculation

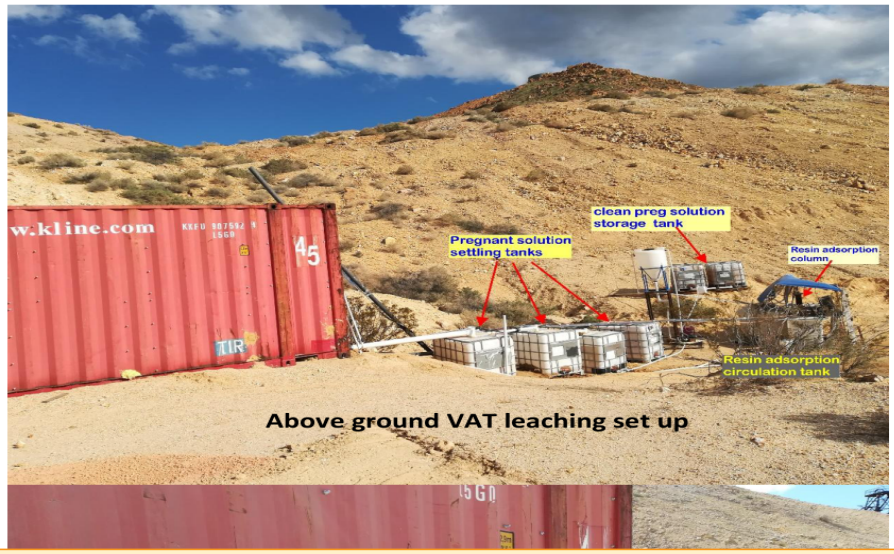
PNI Ecosafe - 98 mass to add (kg) = [target concentration - measured concentration] x total solution volume (m3)

Example: Total vat solution volume = 100 m3; target = 1.2 per mille; measured = 0.7 per mille. Required make-up = (1.2 - 0.7) x 100 = **50 kg**.

This simplified calculation assumes no material solution loss, evaporation or volume change. Confirm actual inventory and solution density before dosing. Add reagent progressively under circulation and re-test before further addition.

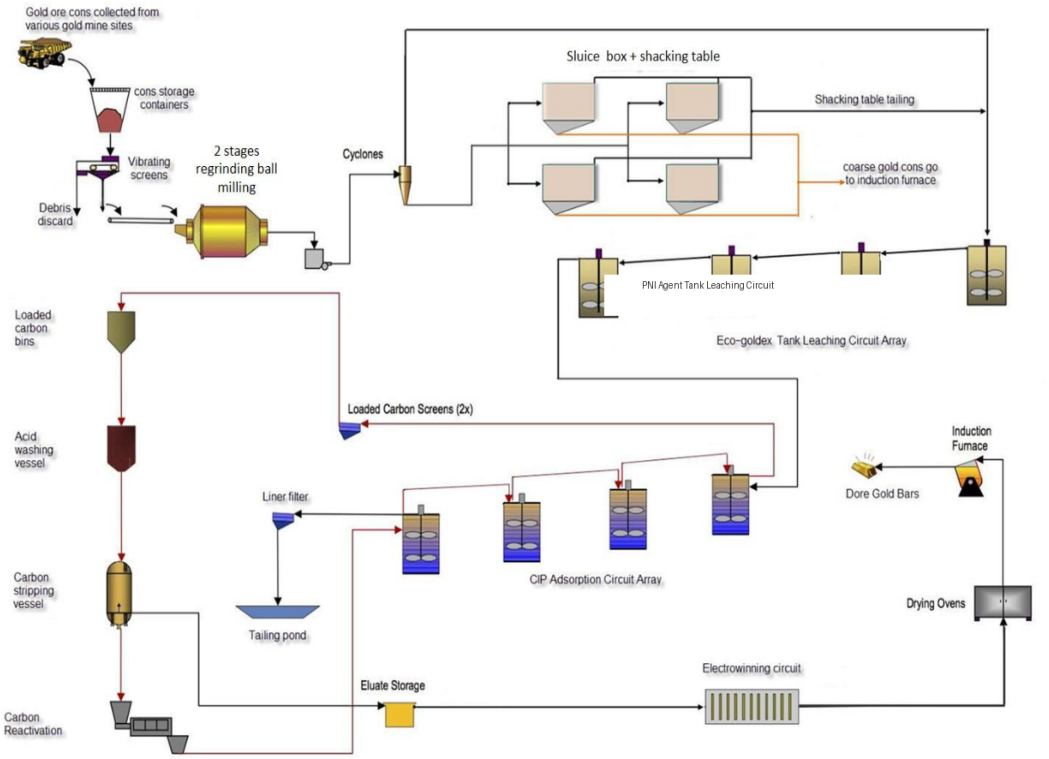
Appendix II - Solution Preparation and Operating Cycle

Step	Procedure
1	Fill the solution-preparation tank with fresh water and record the actual volume.
2	Add lime or NaOH under agitation until pH reaches approximately 11.0-11.5.
3	Select the testwork-approved reagent concentration. Example: 0.65 kg/t water x 1.5 t water = 0.975 kg PNI Ecosafe - 98.
4	Distribute PNI Ecosafe - 98 slowly over the tank under circulation. Confirm complete dissolution and condition for approximately 3-4 hours.
5	Transfer solution to the heap, vat or agitated-tank circuit. For vat leaching, maintain solution approximately 10-15 cm above the ore surface, wher
6	Monitor concentration by titration and add make-up reagent when required.
7	Continue until the target leaching rate or residue grade is achieved.
8	Transfer residue to the approved tailings-management facility and recover precious metal from pregnant solution.
9	Recycle barren or diluted solution to the preparation circuit for the next batch, subject to solution-quality control.



Before each campaign, issue a batch sheet recording water volume, pH, reagent addition, time, temperature, assay results, solution inventory, recovery data and operator approval.

8. Typical Process Configuration and PNI Contact



The illustrated arrangement is a conceptual reference only. Final equipment selection, materials of construction, capacity, instrumentation and HSE design must be completed by qualified engineers for the specific ore and site.

Commercial and technical coordination

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