Konstruktionsunterschiede zwischen HTR-PM und THTR-600 mod.

Diese Zusammenstellung basiert auf Informationen **erfahrener und verantwortlicher deutscher Personen auf dem Gebiet der Hochtemperatur-Reaktoren, speziell der Kugelbett –Technik.** Die eine Seite bringt konkrete Erfahrungen mit den **monolithischen AVR und THTR-300** ein. Die andere befürwortet für China das **modulare Konzept** aufgrund neuer Berechnungen und Betrachtungen.

Hier geht es darum, rechtzeitig vor dem Anlaufen des HTR-PM alle Bedenken, aber auch Positiva zu dem dort verwendeten Konzept zu dokumentieren. Wir sind bewusst, dass uns die konkrete deutsche Situation bezüglich Kerntechnik jeden Handlungs-Einfluss unmöglich macht, weil wir weder Macht noch Finanzen haben.

Das entbindet uns nicht von der Pflicht, unsere Kenntnisse und Einschätzungen klar und deutlich zur Kenntnis zu bringen, damit ein Misserfolg dieser Technik sie nicht dauerhaft in Verruf bringt.

Den mitwirkenden Experten danke ich ausdrücklich für ihre andauernde Hilfe und bitte darum, ihre Namen hier nennen zu dürfen. xx xx xx xx xx

Bei unklaren Formulierungen habe ich als Nicht-Fachmann eigene Deutungen und Überlegungen in der Schriftart Courier eingefügt.

Jochen Michels

Wegen der Sensibilität mancher Inhalte wurde der Text verfremdet. Interessenten wenden sich bitte an den Webmaster Jochen Michels

Design differences between HTR-PM and THTR-600 mod.

This paper is composed on the basis of direct information from **responsible and experienced personalities in the field of High Temperature Reactors, specifically pebble bed technology.** One opinion, based on real experiences with **AVR and THTR-300 favors monolithic design,** the other defends for China the **modular concept** under construction, based on new calculations and considerations.

The aim is to document all concerns, but also the positive, of the modular concept before the HTR-PM will start. We are aware that the concrete German situation with respect to nuclear technology makes it impossible for us to influence any action. We just do not have power nor finance.

This does not absolve us of the obligation to speak out our knowledge and assessments clear and loud, thus to help prevent a permanent disrepute of this technology in case of a possible failure.

Here my intense thank goes to the cooperating experts for their ongoing support and I woul be happy to get their permission to list their names here. Xx xx xx xx xx xx

In case of unclear wording, as a non-expert, I inserted my own interpretations and deliberations in Courier font.

Jochen Michels.

Because of some sensitive content in this paper, the text has been encrypted. If you are interested in a full version, please mail to: Jochen-dot-michels- at-jomi1-dot- com

Das Konzept „THTR/VTHTR-600 mod.“- ist offenbar eine Fortschreibung des THTR-300 in Hamm mit doppelter Kapazität. Es ist basiert auf Erfahrungen mit dem AVR und THTR-300 und hat u.a folgende Eigenschaften: • den ringförmigen Core • Steuerstäbe innerhalb der Grafit-Reflektoren • Helium/Helium Wärmetauscher anstelle Dampf-Erzeuger • mehrere Kugel-Abzüge	By "THTR/VTHTR-600 mod." the main author proposes a concept which further extends the THTR-300 in Hamm and has double capacity. Based on his experiences with the AVR and THTR-300 it carries the following features: • Ring-shaped core • Control rods within the graphite reflectors • Helium/Helium heat exchanger instead steam generator • Multiple pebble outlets

Geschichtliches	**A. Historical background**

Design differences HTR-PM and the THTR-600 concept

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✋■ ♘♘♘☼ ◆♒♏ ♏☒□♏ ❒♓♏■♍♏♦ ♦♓◆♒ ♒♓♑♒♘◆ ♏❍□♏❒♋◆◆❒♏ ❒♏♋♍◆□❒ ♦ ♦♏❒♏ ♦◆♌❍♓◆◆♏♎ ◆□ ◆♒♏■ ♚♓■♓♦◆♏❒ □♐ ☜♍ □■□❍♓♍♦ ♓■ ☠☼♐ ♦◆♋◆♏ ☎♚♦ ✌♒❒♓♦◆♋ ❄♒□♌♏■ ◑ ♋■♎ ♐♏♎♏❒♋● ❍♓■♓♦ ◆♏❒ ♘❒□♐♘ ♘❒♘ ♦♍♒ ♋❖♋■ ◆□□■ ◆♒♏♓❒ ❒♏ ❑◆♏♦◆♘

❄□♑♏◆♒♏❒ ♦♓◆♒ ♘❒ □♐♘ ♘❒♘ ☺◆❒◆ ☺◆♑♏ ●♏❒♘ ♘❒□♐♘ ♐□❒ ☼♏ ♋♍◆□❒ ☜■♑♓■♏♏❒♓■♑ ♋◆ ◆♒♏ ♐♋■ ♦♓■♏❒ ♏■♏ ■♏◆♏♦ ☺□■⌘ ♏□◆ ♐✓❒ ♏♓■♏■ ♑❒♘♦♦♏❒♏ ■ ☺◆♑♏●♌♏◆◆ ♘❄☼ ♏❒♋❒♌ ♏♓◆♏◆ ◆■♎ ♎□&◆❍♏■◆♓♏❒ ◆♘ ♋♌♏♓ ♦◆❒♎♏■ ■♏◆♏ ♦♓♍♒♏❒♒♏♓◆♦◆♏♍♒■♓♦♍♒♏ ☼♓♍♒◆●♓■♓♏■ ⌘◆❍ ✌♋◆ ♑❒□←♏❒ ❄♘❄☼♘☺☺♐ ☎❄♒□❒ ♓◆❍♘♘□♍♒♘❄♏❍□♏❒♋◆◆❒ ☺♏❒■&□♋♐♦♦♏❒&♏◑ ❖□❒♑ ♏●♏♑◆♘ ♎♓♏ ✓♌♏❒ ♎♏■ ♎♏❒⌘♏♓◆♓♑♏■ ♦◆♋■♎♋❒♎ ♋◆♍♒ ❖□■ ☹♐☼♘☺☺♐ ☎☹♏♓ ♍♒◆♘♐♋♦♦♏❒♘☼♏♋&◆□❒♋☺☺ ♐◑ ♒♓■♋◆♦♑♏♒♏■♘

♘♏♒♏■ ♦♓♏ ♋◆♍♒ ✓♌♏❒ ♎♓♏ ♋&◆◆♏●●♏■ ♁□❒♦♍♒ ❒♓♐◆♏■ ♐✓❒ ♘♏■ ✋♁ ☺◆♑♏ ●♌♏◆◆ ♒♓■♋◆♦✍ ♐◆❍ ✌♏♓♦ □♓♏● ✓♌♏❒ ♎♓♏ ◆■◆♏■ ♏ ❒♦♐♒■◆♏■ ❍♋☒♘ ♘☎❒ ♚♐◆ ♒♘✍

✋■ ♏♓■♏❍ ♁□❒◆❒♋♑ ♌♏ ♓❍ ✋✌✌☞☞ ♓■ ☠♓⌘⌘♋ ♘❒♘ ♦◆❒♎♏■ ☜♓■⌘♏●♒♏♓◆♏■ ❖♏❒♐♐♐♏■◆●♓♍♒◆♘ ♦□❒♋■ ♋◆♍♒ ♎♏❒ ♓■⌘♦♓♦♍♒♏■ ❖ ♏❒♦◆□❒♌♏■♏ ♏♒♏❍♘ ♁□❒♦ ◆♋■♎♦♘♁□❒♦♓◆⌘♏■♎♏ ♎♏❒ ♁☞♐ ✌✌♘ ♐♏❒❒ ♐❒♘♘✋■♑♘ ♐❒♘♘✋■♑ ♏♘♒♘ ☺●♋◆♦ ☺■♓⌘♓♋ ❍♓◆♑♏♦♓❒&◆ ♒♋ ◆♘

♐♏♓◆♏❒♏ ➲♌♏❒●♏♑◆■♑♏ ■ ⌘◆❒ ☞●♋■◆■♑ &□❍♌♓■♓ ◆□ ✌♒♓■♋ □■●♘ ◆□ ♋ ●♓❍♓◆♏♎ ♏☒◆♏■◆♘

✋■ ♘♘♘☼ ◆♒♏ ♏☒□♏ ❒♓♏■♍♏♦ ♦♓◆♒ ♒♓♑♒♘◆ ♏❍□♏❒♋◆◆❒♏ ❒♏♋♍◆□❒ ♦ ♦♏❒♏ ♦◆♌❍♓◆◆♏♎ ◆□ ◆♒♏■ ♚♓■♓♦◆♏❒ □♐ ☜♍ □■□❍♓♍♦ ♓■ ☠☼♐ ♦◆♋◆♏ ☎♚♦ ✌♒❒♓♦◆♋ ❄♒□♌♏■ ◑ ♋■♎ ♐♏♎♏❒♋● ❍♓■♓♦ ◆♏❒ ♘❒□♐♘ ♘❒♘ ♦♍♒ ♋❖♋■ ◆□□■ ◆♒♏♓❒ ❒♏ ❑◆♏♦◆♘

♐♏♓◆♏❒♏ ➲♌♏❒●♏♑◆■♑♏ ■ ⌘◆❒ ☞●♋■◆■♑ &□❍♌♓■♓ ◆□ ✌♒♓■♋ □■●♘ ◆□ ♋ ●♓❍♓◆♏♎ ♏☒◆♏■◆♘

✋■ ♘♘♘☼ ◆♒♏ ♏☒□♏ ❒♓♏■♍♏♦ ♦♓◆♒ ♒♓♑♒♘◆ ♏❍□♏❒♋◆◆❒♏ ❒♏♋♍◆□❒ ♦ ♦♏❒♏ ♦◆♌❍♓◆◆♏♎ ◆□ ◆♒♏■ ♚♓■♓♦◆♏❒ □♐ ☜♍ □■□❍♓♍♦ ♓■ ☠☼♐ ♦◆♋◆♏ ☎♚♦ ✌♒❒♓♦◆♋ ❄♒□♌♏■ ◑ ♋■♎ ♐♏♎♏❒♋● ❍♓■♓♦ ◆♏❒ ♘❒□♐♘ ♘❒♘ ♦♍♒ ♋❖♋■ ◆□□■ ◆♒♏♓❒ ❒♏ ❑◆♏♦◆♘

♐♏♓◆♏❒♏ ➲♌♏❒●♏♑◆■♑♏ ■ ⌘◆❒ ☞●♋■◆■♑ &□❍♌♓■♓ ◆□ ✌♒♓■♋ □■●♘ ◆□ ♋ ●♓❍♓◆♏♎ ♏☒◆♏■◆♘

✋■ ♘♘♘☼ ◆♒♏ ♏☒□♏ ❒♓♏■♍♏♦ ♦♓◆♒ ♒♓♑♒♘◆ ♏❍□♏❒♋◆◆❒♏ ❒♏♋♍◆□❒ ♦ ♦♏❒♏ ♦◆♌❍♓◆◆♏♎ ◆□ ◆♒♏■ ♚♓■♓♦◆♏❒ □♐ ☜♍ □■□❍♓♍♦ ♓■ ☠☼♐ ♦◆♋◆♏ ☎♚♦ ✌♒❒♓♦◆♋ ❄♒□♌♏■ ◑ ♋■♎ ♐♏♎♏❒♋● ❍♓■♓♦ ◆♏❒ ♘❒□♐♘ ♘❒♘ ♦♍♒ ♋❖♋■ ◆□□■ ◆♒♏♓❒ ❒♏ ❑◆♏♦◆♘

♐♏♓◆♏❒♏ ➲♌♏❒●♏♑◆■♑♏ ■ ⌘◆❒ ☞●♋■◆■♑ &□❍♌♓■♓ ◆□ ✌♒♓■♋ □■●♘ ◆□ ♋ ●♓❍♓◆♏♎ ♏☒◆♏■◆♘

✋■ ♘♘♘☼ ◆♒♏ ♏☒□♏ ❒♓♏■♍♏♦ ♦♓◆♒ ♒♓♑♒♘◆ ♏❍□♏❒♋◆◆❒♏ ❒♏♋♍◆□❒ ♦ ♦♏❒♏ ♦◆♌❍♓◆◆♏♎ ◆□ ◆♒♏■ ♚♓■♓♦◆♏❒ □♐ ☜♍ □■□❍♓♍♦ ♓■ ☠☼♐ ♦◆♋◆♏ ☎♚♦ ✌♒❒♓♦◆♋ ❄♒□♌♏■ ◑ ♋■♎ ♐♏♎♏❒♋● ❍♓■♓♦ ◆♏❒ ♘❒□♐♘ ♘❒♘ ♦♍♒ ♋❖♋■ ◆□□■ ◆♒♏♓❒ ❒♏ ❑◆♏♦◆♘

♐♏♓◆♏❒♏ ➲♌♏❒●♏♑◆■♑♏ ■ ⌘◆❒ ☞●♋■◆■♑ &□❍♌♓■♓ ◆□ ✌♒♓■♋ □■●♘ ◆□ ♋ ●♓❍♓◆♏♎ ♏☒◆♏■◆♘

✋■ ♘♘♘☼ ◆♒♏ ♏☒□♏ ❒♓♏■♍♏♦ ♦♓◆♒ ♒♓♑♒♘◆ ♏❍□♏❒♋◆◆❒♏ ❒♏♋♍◆□❒ ♦ ♦♏❒♏ ♦◆♌❍♓◆◆♏♎ ◆□ ◆♒♏■ ♚♓■♓♦◆♏❒ □♐ ☜♍ □■□❍♓♍♦ ♓■ ☠☼♐ ♦◆♋◆♏ ☎♚♦ ✌♒❒♓♦◆♋ ❄♒□♌♏■ ◑ ♋■♎ ♐♏♎♏❒♋● ❍♓■♓♦ ◆♏❒ ♘❒□♐♘ ♘❒♘ ♦♍♒ ♋❖♋■ ◆□□■ ◆♒♏♓❒ ❒♏ ❑◆♏♦◆♘

♐♏♓◆♏❒♏ ➲♌♏❒●♏♑◆■♑♏ ■ ⌘◆❒ ☞●♋■◆■♑ &□❍♌♓■♓ ◆□ ✌♒♓■♋ □■●♘ ◆□ ♋ ●♓❍♓◆♏♎ ♏☒◆♏■◆♘

✋■ ♘♘♘☼ ◆♒♏ ♏☒□♏ ❒♓♏■♍♏♦ ♦♓◆♒ ♒♓♑♒♘◆ ♏❍□♏❒♋◆◆❒♏ ❒♏♋♍◆□❒ ♦ ♦♏❒♏ ♦◆♌❍♓◆◆♏♎ ◆□ ◆♒♏■ ♚♓■♓♦◆♏❒ □♐ ☜♍ □■□❍♓♍♦ ♓■ ☠☼♐ ♦◆♋◆♏ ☎♚♦ ✌♒❒♓♦◆♋ ❄♒□♌♏■ ◑ ♋■♎ ♐♏♎♏❒♋● ❍♓■♓♦ ◆♏❒ ♘❒□♐♘ ♘❒♘ ♦♍♒ ♋❖♋■ ◆□□■ ◆♒♏♓❒ ❒♏ ❑◆♏♦◆♘

♐♏♓◆♏❒♏ ➲♌♏❒●♏♑◆■♑♏ ■ ⌘◆❒ ☞●♋■◆■♑ &□❍♌♓■♓ ◆□ ✌♒♓■♋ □■●♘ ◆□ ♋ ●♓❍♓◆♏♎ ♏☒◆♏■◆♘

♏❒♦♏❒ ☜❒⌘♏◆♑◆■♑ ⬩□●●♏ ■ ♌♏♓ ♎♏❒ ❄♋♑◆■♑💻

❽❄♒♏ 🖮♦♒ ⌖□❒●♎ 🖈♘♎❒□ ♑♏■ ❄♏♍♒■□●□♑♘ 👌□■❖♏■ ♦♓□■ 🕮 👌⌘♏♍♒ 🖈♘♎❒□♑♏■ 🖈♋♘⬩❾🖃 🖻❒♋♑◆♏🖃 ☺◆●♘ 🗎🗀🗁🖮 ❖□❒♑♏⬩♦♏●●♦ ⬩♏❒ ♎♏■🖃

B. Unterschiede und Begründung

🖈♓♏⬩♏ ☺□■⌘♏□♦♓□■ ♑❒□ ←♏❒ 🖈❄☼🖃☺☺⌖ ◆■♦♏❒⬩♍♒♏♓ ♎♏♦ ⬩♓♍♒ ♓■ ⬩♓♍♒♦♓♑♏■ ☞❒♋♑♏■ ♏❒♒♏♌●♓♍♒ ❖□❍ 👌♒♓■♋🖃🖈❄☼🖃🖻💣 🖻❒□𝑒𝑟♏&♦🖃 ❖□❒ ♋●●♏❍ ♓■ ⬩♓♍♒♏ ❒♒♏♓♦⬩♦♏♍♒■♓⬩♍♒♏■ ✌⬩□♏ &♦♏■🖃 🖈♓♏ ♏❒⬩↗♒■♦♏■ ♒ □♒♏■ 💧♓♍♒♏❒♒♏♓♦⬩&❒♓♦♏ ❒♓♏■ &⬀■■♏■ ❍♓♦ ♎♏❍ ☺ □■⌘♏□♦ 🖈❄☼🖃🖻💣 ♋ ⬩□⬩♏♓♦ ♎♓♏⬩♏⬩ ◆■⬩ ♌♏&♋■■♦ ♓⬩♦ 🖃 ♦♏♓●⬩♏♓⬩♏ ■♓♍♒♦ ♏❒❒ ♏♓♍♒♦ ⬩♏❒♎♏■🖃

🖈♓♏ ⬩♓♍♒♦♓♑⬩♦♏■ ☺□■⬩♦ ❒◆&♦♓□■⬩❍♏❒&❍♋●♏ ♎♏⬩ ☺□■⌘♏□♦♏⬩ ♑❒□←♏❒ ✞🖈❄☼🖃 ☺☺⌖ ☎✞♏❒♘ 🖈♓♑♒ ❄♏❍□♏❒ ♋♦◆❒♏ ♋ ☺☺⌖◑ ⬩♓■♎ ■♋♍ ♒↗□●♑♏■♎ ♎♋❒♑♏●♏♑♦🖃

🖈♓♏ 👌❒♏■■⬩♦□↗↗□♋❒♦♓&♏● ⬩♓■♎ ❍♓♦ ❄☼✋💧⚐ 👌□♋♦♓■♑ ❖♏❒⬩♏♒♏■🖃 ♓■ ♏♓■♏❒ 💣♋♦❒♓☒ ☎🖻●♋⬩♦♓& ◆■♎ 🖈❒♋↗♓♦◑ ♏♓■♑♏♌♏♦♦♏♦ ◆■ ♎ ❖□■ ♎♏❒ 🖈❒♋↗♓♦♒✓●●♏ ♎♏❒ 👌❒♏■■♏●♏❍♏■♦&◆♑ ♏●■ ☎□♏♌♌●♏⬩◑ ◆❍⬩♍♒●□⬩⬩ ♏■🖃 💧□●♍♒♏ ☺◆♑♏●■ ⬩◆❒ ♎♏■ ♓❍ ✌✞☼ ✓♌♏❒ 🗎🗎 ☺♋ ♒❒♏ ♓■ ❖♏❒⬩♍♒♓♏♎♏■♏■ ☪◆⬩♋❍❍♏■⬩♏♦⌘◆■♑♏■ ♎♏⬩ 💧□♋●♦❍♋♦♏❒♓♋●⬩ ♏❒□❒□♌♦ 🖃 ✌◆♍♒ ♓❍ ❄🖈❄☼🖃🗎🗀🗀 ⬩◆ ❒♎♏■ ♎♓♏⬩♏ ☺◆♑♏●■ ♏♓■ ♑♏⬩♏♦⌘♦🖃 ☹♋■♑↗❒♓⬩♦♓♑♏ 👌♏♦❒♓♏♌⬩♏❒↗♋♒❒◆■♑♏■ ♒♋♦ ❍♋■ ⬩♏●♦⬩♏♓♦ ♌♓⬩●♋ ■♑ ■◆❒ ❍♓♦ ♎♓♏⬩♏■ ♌♏♓♎ ♏■ 🖈❄☼🖃☺☺⌖ ♑♏⬩□■■♏■🖃

□↗ ♍□❍♌♓■♏♎ □❒□♎◆♍♦ ♓□■ ⬩♓●● ♌♏ □❒♏⬩♏■♦♏ ♎ ♋♦ ♦♒♏ ♍□■↗♏❒♏■♍ ♏💻

✂❄♒♏ 🖮♦♒ ⌖□❒●♎ 🖈 ♘♎❒□♑♏■ ❄♏♍♒■□●□♑♘ 👌□■❖♏■♦♓□■ 🕮 👌⌘♏♍♒ 🖈♘♎❒□♑♏■ 🖈♋♘⬩✂🖃 🖻 ❒♋♑◆♏🖃 ☺◆●♘ 🗎🗀🗁🖮 🖃

B. Differences and their foundation

❄♒♓⬩ ♍□■♍♏□♦ □↗ ● ♋❒♑♏ 🖈❄☼🖃☺☺⌖ ♎♓↗↗♏ ❒⬩ ⬩♓♑■♓↗♓♍♋■♦●♘ ↗❒□ ❍ ♦♒♏ 👌♒♓■♏⬩♏ 🖈❄☼🖃🖻 💣 □❒□𝑒𝑟♏♍♦ ♓■ ♓❍□□❒♦ ♋■♦ ♓⬩⬩◆♏⬩🖃 □♋❒♦♓♍◆● ♋❒●♘ ⬩♋↗♏♦♘ ♋⬩□♏♍♦⬩ 🖃 ✋■ □♋❒♦ ♦♒♏ ♒♓♑ ♒ ⬩♋↗♏♦♘ ♍❒♓♦♏❒♓♋ ♎♏❍♋■♎♏■ ♎♘ ☺◆♑♏●♏ ❒ ♍♋■■□♦ ♌♏ ♋♍♒♓♏❖ ♏♎ ♌♘ ♦♒♏ ♍□■♍♏□♦ 🖈❄☼🖃🖻💣 🖃 ♋⬩ ↗♋❒ ♋⬩ ⬩♒♋♦ ⬩♏ &■□⬩ ♋♌□◆♦♦ ♓♦🖃

❄♒♏ ❍□⬩♦ ♓❍□□❒♦♋■ ♦ ♎♏⬩♓♑■ ↗♏♋♦◆❒♏⬩ □ ↗ ♦♒♏ ♍□■♍♏□♦ ↗□❒ ● ♋❒♑♏ ✞🖈❄☼ ☠🖻🖻⬩ ☎✞♏❒ ♘ 🖈♓♑♒ ❄♏❍□♏❒♋♦◆❒♏ 🖃 ☺☺⌖◑ ♋❒♏ ♎♓⬩♍◆⬩⬩ ♏♎ ♌♏●□⬩🖃

❄♒♏ ↗◆♏● □♋❒♦♓♍● ♏⬩ ♋❒♏ ♍□❖♏❒♏♎ ⬩♓♦♒ ❄☼✋💧⚐ ♍□♋♦♓■♑🖃 ♏❍ ♌♏♎♎♏♎ ♓■ ♋ ❍♋♦❒♓☒ ☎□●♋⬩♦♓♍ ♋■♎ ♑❒♋□ ♒♓♦♏◑ ♋■♎ ♏■♍●□⬩♏♎ ♓■ ♦♒♏ ♑❒♋□♒♓♦♏ ⬩♒ ♏●● □↗ ♦♒♏ ↗◆♏● ♏● ♏❍♏■♦⬩ ☎⬩□♒♏❒♓♍♋● □ ♏♌♌●♏⬩◑🖃 💧◆♍♒ □♏♌♌ ●♏⬩ ⬩♏❒♏ ♦♏⬩♦♏♎ ♓■ ✌ ✞☼ ↗□❒ 🗎🗎🖭 ♘♏♋❒⬩ ♓■ ❖♋❒♓□◆⬩ ♍□❍□□⬩♓♦♓□■⬩ □↗ ♦♒♏ ↗♓⬩⬩♓□■ ❍♋♦ ♏❒♓♋●🖃 ❄♒♏⬩♏ □♏♌♌● ♏⬩ ⬩♏❒♏ ♋●⬩□ ◆⬩♏♎ ♓■ ♦♒♏ ❄🖈❄☼🖃🗎🗀🗀🖃 ☹□■ ♑🖃♦♏❒❍ □□♏❒♋♦♓■♑ ♏ ☒□♏❒♓♏■♍♏ ⬩□ ↗♋❒ □■

	●♎ ♏☒♓♦◆♦ ♦♓◆♒ ◆♒♏♦♏ ◆♦□ ♈❄☼ ☠♋♋♐
♑♦♓♦♍♒♏■ ♎♏■ ☺□■⌘♏□◆♏■ ❄♈❄☼♐▤▭▭ ◆■♎ ♈❄☼♐♋ ●♓♏♑♏■ ♎♓♏ ♦♓♍♒◆♓♑♦◆♏■ ✞■◆♏❒♦♍♒♓♏♎♏💻	♓♏◆♦♏♏■ ◆♒♏ ♎♏♐◆■♍◆ ❄♈❄☼♐▤▭▭ ♋■♎ ◆♒♏ ♍□■♍♏□◆ ♈❄☼♐♋ ◆♒♏ ♋♓■ ♎♓♐♐♏❒♏■♍♏♦♏□♓♦◆ ♓■ ◆♒♏💻
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• ♓■ ♎♏❒ ☜♓♋♏■♦♓□■♓♏❒◆■♑ ♎♏♦ ☝□❒♏♦♋	• ♎♓♋♏■♦♓□■♓■♑ □♐ ◆♒♏ ♍□❒♏♋
• ♓♋ ☞●◆♦♦ ♎♏♦ ☺✓♒●♑♋♦♏♦	• ♐●□♦ □♐ ◆♒♏ ♍□□●♓■♑ ♑♋♦
✌●♦ ♌♏♦□■♎♏❒♏♦ ♁♏❒&♋♋● ♦♓□♎ ♏♓■ ♏♓■⌘♓♑♏❒ ☜❒◆♍&♌♏♒♐●◆♏❒ ♋◆♦ ♁◆♋■■♌♏◆□■ ♒♏❒❖□❒♑♏♒□♌♏■ ♋ ♎❒ ❖□■ ♋♓♦ ♋□ ♋□□ ◆■◆♏❒ ♋♋◆♏■♦♍♒◆◆⌘♦◆♋■♎♋ ♦♋♦ ♏♓■ ♏❒◆■♎ ♑♦♏♦♏■ ♦♏♓■ &♐■■◆♏♋ ♎♓♏■ ♐✓❒ ♈❄☼♐♋♁ ♓■ ♋♒♓■♋ ⌘◆ ❖♏❒♋♏♓♎♏■♋ ☜□❒◆ ♦♏❒♎♏■ ♦◆♋◆◆ ♎♏♦♦♏■ ☜□◆♍&♌♏♒♐●◆♏❒ ♋◆♦ ♁◆♋♒● ♏♓■♑♏♦♏◆⌘◆♋	♑■◆□ ◆♒♏ ♋□♎◆●♋❒ ♍□■♍♏□◆ ♐□❒ ◆♒♏ ♈❄☼♐♋♁ ☎♋■♎ ◆♒♏ ♏♋❒ ●♓♏❒ ♈❄☼♐▭▭ ♋◆ ❄♦♓■♑♒◆♋ ✞■♓❖♏❒♦♓◆♎♋ □◆♒♏❒ ♋♏❒♋■ ♏♐♐□❒◆♦♋ ◆□♑♏◆♒♏■ ♈❄☼♐♋ ♁♑♋ ♑■◆♏❒♋◆□♋ ♏■◆♦♓♍&♏● ◆ ♦◆❒♎♏♋ ♑♓♌◆ ♏♦ ♋♋■■ ♓♑♐♋♍♒♏ ♌♦♏♓♍♒◆■♑♏■ ♑♏♑♏■✓♌♏❒ ♎♏♋ ♈❄☼♐▤▭ ▭ ◆■♎ ❄♈❄☼♐⌛▭▭ ♋□♎♋ ♁□ ♦◆♏♒♏■ ♦♓♍♒ ♒♓♏❒ ♎♓♏ ♋□■□●♓◆♒♓♦♍♒♏ ♑♋◆♦ ♏♓♦♏ ◆■♎ ♎♓♏ ♋□♎◆●♋❒♏ ♐✓❒ ♑♒♓■♋ ♋◆♦♑♏♦♐♒● ◆♋ ♑♏♑♏■✓♌♏❒	♕■◆□ ◆♒♏ ♋□♎◆●♋❒ ♍□■♍♏□◆ ♐□❒ ◆♒♏ ♈❄☼♐♋ ☎♋■♎ ◆♒♏ ♏♋❒ ●♓♏❒ ♈❄☼♐▭▭ ♋◆ ❄♦♓■ ♑♒◆♋ ✞■♓❖♏❒♦♓◆♎☽ □◆ ♒♏❒ ♑♏❒♋■ ♏♐♐□❒◆♦♋ ◆□♑♏◆♒♏ ♈❄☼♐♋ ♁♑♋ ♑■◆♏❒♋◆□♋ ♦♏■ ◆ ♓■♋ ♁♋■♎ ♎♓♐♐♏❒♏ ■♍♏♦ ❖♏❒♦◆♦ ◆♒♏ ♈❄☼♐▤▭▭ ♋■♎ ❄♈❄☼♐⌛▭▭ ♋□♎♋ ♦□ ♦◆♏♒♏■ ♦♓♍♒♏ ♎♓♌♏ ♋□■□●♓◆♒♓♦♍♒♏ ♑♋◆♦ ♏♓♦♏ ◆■♎ ♎♓♏ ♋□♎◆●♋❒♏ ♐✓❒ ♑♒♓■♋ ♋◆♦♑♏♦♐♒● ◆♋ ♑♏♑♏■✓♌♏❒	♕■ □❒♓■♍♓□●♏♋ ◆♒♏ ♋□■□●♓◆♒♓♍ ♍□■♦◆❒◆♍ ◆♓□■ ♓♦ ♋◆☒◆♋□□♦♏♎ ◆ □♦♋❒♎♦ ◆♒♏ ♋□♎◆●♋❒ ♎♏♦♓♑■ ♦♏●♏♍◆♏♎ ♐□❒ ♑♒♓■♋♋
☜♋♦ ❖□■ ♎♏❒ ☒♐♐♏■◆● ♓♍♒♏■ ♈♋■♎ ♓■ ✌◆♐◆❒♋♑ ♑♏♑♏♌♏■♏ ☺□■⌘♏□◆♑◆◆ ♋♍♒◆♏■ ♐✓❒ ♏♓■ ♈❄☼♐♁□ ♎◆●♋☺❒♋♐◆♦♏□& ♦◆❒♎♏ ☜	❄♒♏ ♍□■♍♏□◆◆♋● ♎ ♏♦♓♑■ ♍□♋♋♓♦♦♓□■♏♎ ♌ ♎ ◆♒♏ □◆♌●♓♍ ♋◆◆♒□ ❒♓◆♓♏♦ ♐□❒ ♋■ ♈❄☼ ♋□ ♎◆●♏ □□♦♏❒ □●♋■◆ ♦♋♦

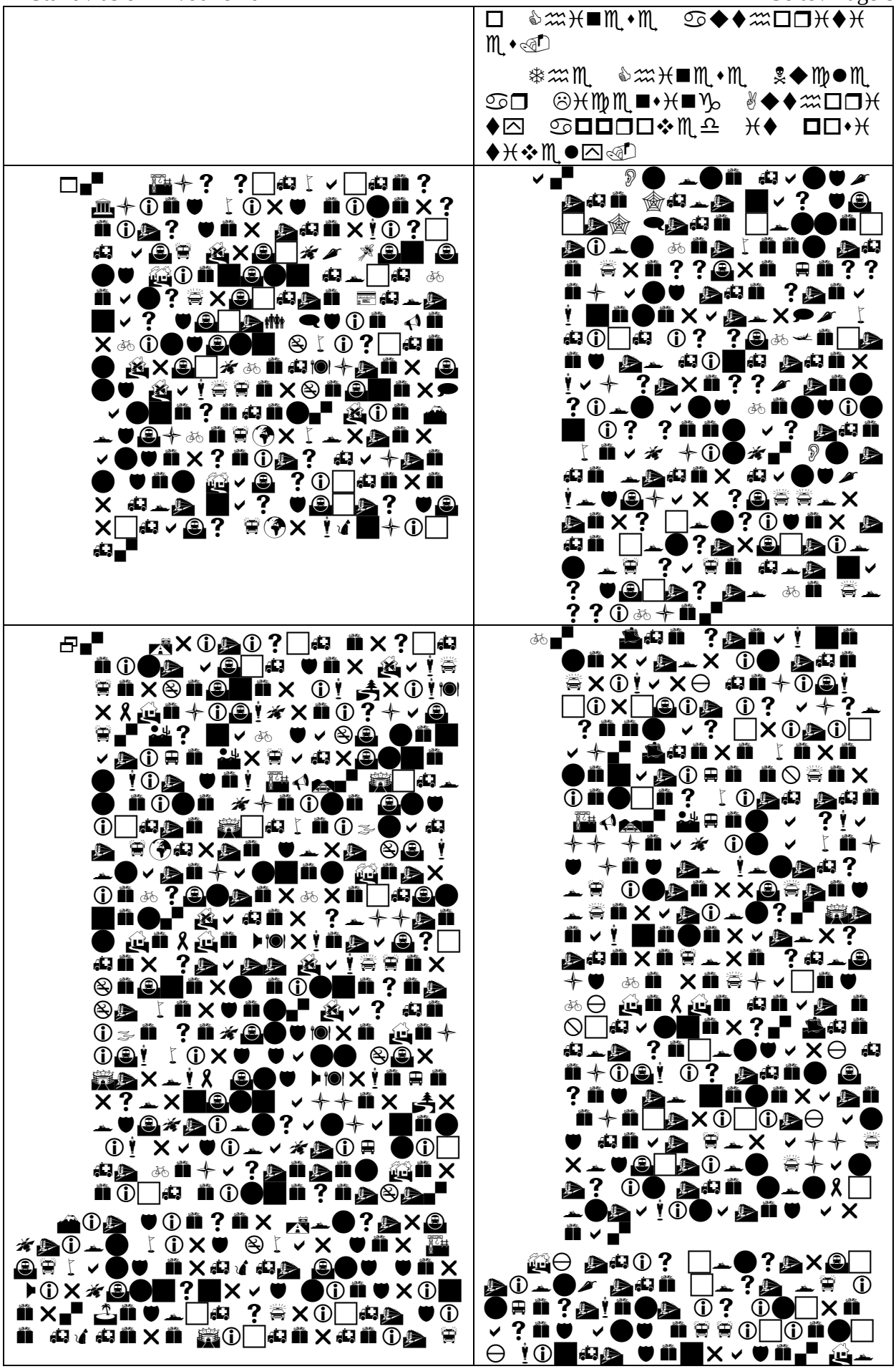
■♎♏ 🗁♋♉♋ ♐♏❒♦♓♑♑♏♦◆♏ ●●◆☞ ✌■♦♍♒●♓♏←♏■♎ ♦◆❒♎ ♏ ♏♦ ♌♓◆ ♏♓■♏❒ ◻◻♦♓◆♓❖ ♏■ ☜♌◻♐♏♒●◆■♑ ♎♏❒ ☼♠☺ ☎☼♏♋&◆◻❒♦♓♍♒♏❒♒♏♓◆♦& ◻♌♌♓♦♦♓◻■☽ &◻♌♌♏■◆♓♏❒◆ ☞ ✋♌ ☝◆◆♋♍♒◆♏■ ♎♏♦ ❄➲ ✞ ☎❄♏♍♒■♓♦♍♒♏❒ ➲♌♏❒♦♋ ♍♒◆■♑♦❖♏❒♏♓■☽ ☞♋■■◻❖♏❒ ♦◆❒♎♏ ♎♋♦ ♠♓♍♒♏❒♒♏♓◆♦ &◻■⌘♏◻◆ ♓■ ♋●●♏■ ♘◆■& ◆♏■ ♌♏♦◆♐◆♓♑♠ ◆■♎ ♎♓♏ ♒◻♒♏■ ♠♓♍♒♏❒♒♏♓◆♦❒♏♦♏❒ ❖♏■ ♌♏◆◻■◆☞ ☜♓♏ ☼♠☺ ♌ ♏♦♏❒◆♏◆♏ ♓■♦♌♏❒ ♠♋♐♎◆♋●●❖♏❒♒♋●◆♏■ ♦◻♦◻♒● ♓♌ ✌◆♦●♏♑◆■♑♦♌♏❒ ♏♓♍♒ ♦♓♏ ♋◆♍♒ ♌♏♓ ♋◆♦ ●♏♑◆■♑♦✓♌♏❒♦♍♒❒♏♓◆♏■♎♏ ■ ☎♒♘◻◻◆♒♏◆♓♦♍♒♏■☽ ☜❒ ♏♓♑■♓♦♋♌●♐◆♐♏■ ◻◻♦♓◆♓❖ ☞

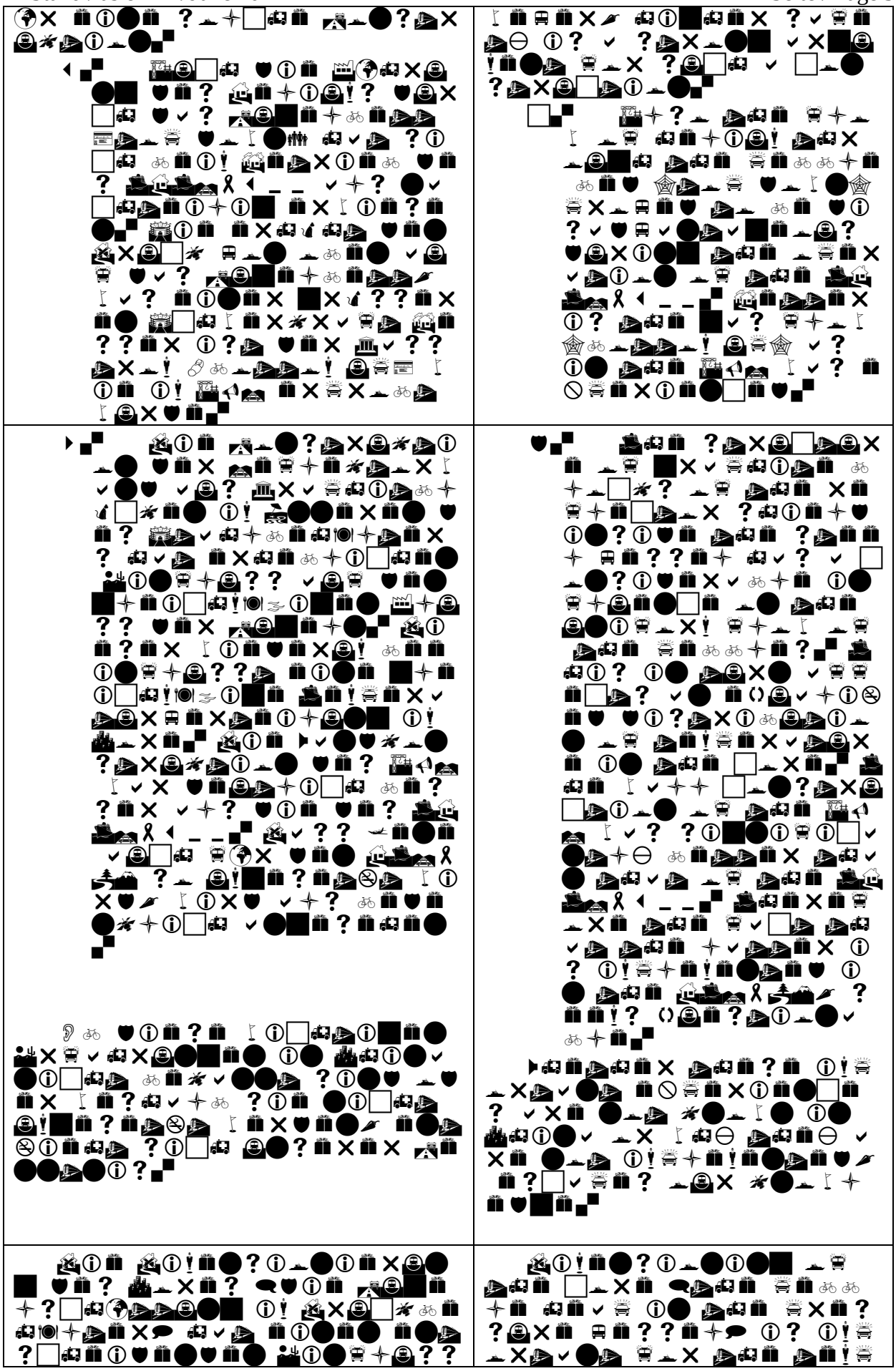
♁♏♑♏■ ♎♏♦ ♐♏♒●♏■♎♏■ ◻◻●♓◆♓♦♍♒♏■ ☺◻■♦♏■♦♏♦ ✓ ♌♏❒ ♎♓♏ ♦♏♓◆♏❒♏ ☠◆◆⌘◆ ■♑ ♎♏❒ ☺♏❒■♏■♏❒♑♓♏ ♓■ ☜♏◆◆♦♍♒●♋■♎ ♦◆❒♎♏■ ♎♓ ♏ ♓■◆♏❒■♋◆♓◻■♋●♏■ ✌♏♌✓ ♒◆■♑♏■ ❖♏❒♦◆♐❒&◆☞ ✌●♦ ☜❒♑♏♌■♓♦ &◻■■◆♏ ♎♏❒ ♎ ♏◆◆♦♍♒☞♍♒♓■♏♦♓♦♍♒♏ ☺◻◻ ◻♏❒♋◆♓◻■♦❖♏❒◆❒♋♑ ♌♓◆ ♎ ♏♌ ♋♓♏● ♎♏❒ ☞●♋■◆■♑ ◆■♎ ☜❒❒♓♍♒◆◆■♑ ♎♏♦ ♦◻♑ ☞ ❄♏♦◆♌◻♎◆●♦ ♋◆♐ ♎♏❒ ◆♏♍♒■♓♦♍♒♏■ ✌♋♦♓♦ ♎♏♦ ♎ ♏◆◆♦♍♒♏■ ☞❄☼☞♠◻♎◆●☞☺◻ ■⌘♏◻◆♏♦ ♋◆♐ ♎♏♌ ☝♏●♐■♎ ♏ ♎♏❒ ❄♦♓■♑♒◆♋☞✞■♓❖♏❒♦ ♓◆♐◆ ♓■ ✌♏♓♂♓■♑ ♑♏♦♍♒● ◻♦♦♏■ ♦♏❒♎♏■☞ ☠♋♍♒ ✌♌♦ ♍♒●◆♦♦ ♎♏❒ ♑♏♌♏♓■♦♋♌ ♎ ◆❒♍♒♑♏♐✓♒❒◆♏■ ☺◻■⌘♏◻◆ ◻♒♋♦♏ ♦◆❒♎♏ ♎♋♦ ✌■●♋♑ ♏■☞ ◆■♎ ♠♓♍♒♏❒♒♏♓◆♦&◻ ■⌘♏◻◆ ♐✓❒ ♎♏■ ❄♏♦◆♌◻♎◆ ● ♎♏❒ ♍♒♓■♏♦♓♦♍♒♏■ ♋◆◻ ♌❒♏♍♒◆●♓♍♒♒♏■ ☝♏■♏♒♌♓♑ ◆■♑♦♌♏♒♐❒♎♏ ❖◻❒♑♏♦◆♏●● ◆ ◆■♎ ❖◻■ ♎♓♏♦♏❒ ◻◻♦♓◆♓ ❖ ♌♏♦♍♒♓♏♎♏■☞

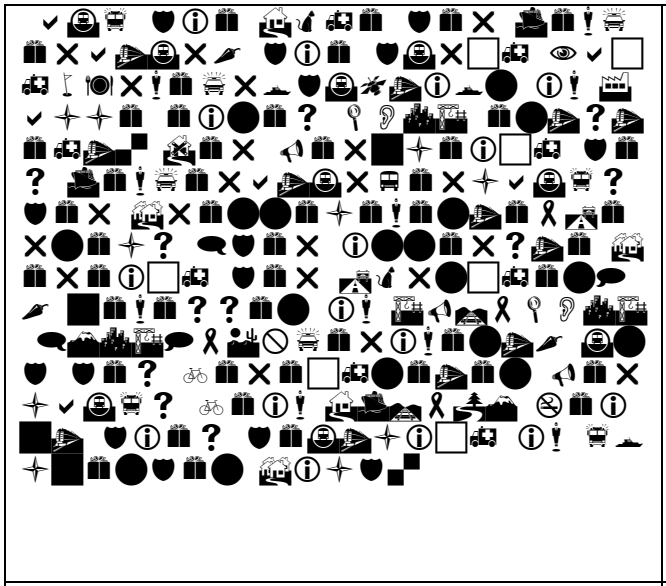
♐♓■♋●♓⌘♏♎ ♋◆ ◆♒♏ ♏■♎ ◻♐ ☞♠◆♌♦ ♏■♦●♘ ◆♒♏ ☼♏♋♍◆ ◻❒ ♠♋♐♏◆◆♘ ◻♌♌♓♦♦♓◻■ ☎☼♠☺☽ ♍◻♌♌♏■◆♏♎ ♓◆ ♦♓◆♒ ♋ ◻◻♦♓◆♓❖♏ ❒♏ ♍◻♌♌♏■♎♋◆♓◻■☞ ❄♒♏ ♦♋♐♍◆♘ ♍◻■♍♏◻◆ ♦♋♦ ♍◻■♐♓❒♌♏♎ ♓■ ♋●● ◻◻ ♓■◆♦ ♌♘ ◆♒♏ ◻◻♓■♓◻■ ❒♏◻❒❒◆ ◻♐ ◆♒♏ ❄➲✞ ☎❄♏♍♒■♓♍♋● ♠◆❒❖♏♓●● ♋■♍♏ ✌♦♦☞☽ ☞♋■■◻❖♏❒ ☞ ❄♒♏ ♒♓♑♒ ♦♋♐♏◆♘ ❒♏♦♏❒❖♏♦ ♦♏❒♏ ♏☒◻❒ ♏♦♦♓❖♏●♘ ♦◆♋◆♏♎☞ ❄♒ ♏ ☼♠☺ ♋♦♦♏♦♦ ◻◻♦♓◆♓ ❖♏●♘ ◆♒♏ ♌♏♒♋❖♓◻❒ ♓■ ♍♋♦♏ ♐♏♒ ♋●●♏■ ◆♒♏♦♏ ●♓○♓◆♦ ♋♦ ♦♏●● ♋♦ ♦♒ ♏■ ◆♒♏♦♏ ●♓○♓◆♦ ♋❒♏ ♏☒♍♏♏♎♏♎ ♓■ ◆♒♏ ☎♒♘◻◻◆♒♏◆♓♍♋●☽ ♍♋♦ ♏ ◻♐ ♋■ ◻◆◆☞◻♐☞❒♋■ ♑♏ ❒♏♦♓♏ ◻♐ ♏❖♏■◆♦ ☞

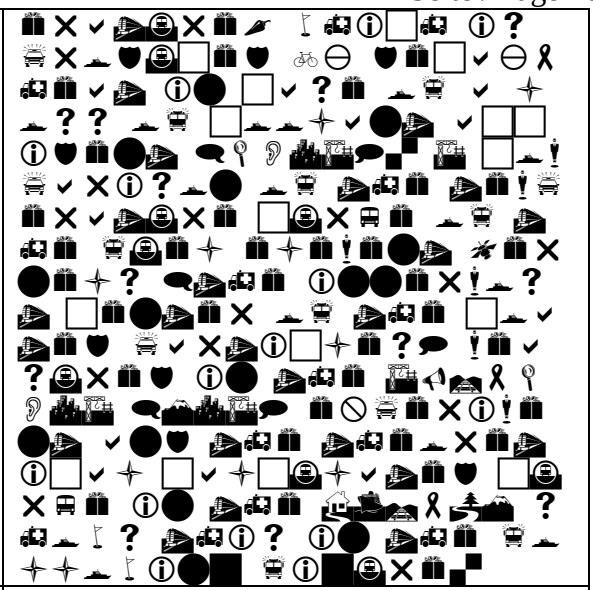
☹♋♍& ◻♐ ◻◻●♓◆♓♍♋ ● ♍◻■♦♏■♦◆♦ ◻■ ◆♒♏ ♍ ◻■◆♓■◆♏♎ ◆♦♏ ◻♐ ■◆♍ ●♏♋❒ ♓■ ☝♏❒○♋■♘ ●♏♎ ◆♘ ♐◻◻♍♏♎ ♓■◆♏❒■♋◆ ♓♦■☞ ❄♒♏ ❒♏♦◆●◆ ♦♋♦ ◆♒♏ ☝♒♓■ ♏■☞☝♏❒○♋■ ♍◻□□■❒♋◆ ♦♋♦ ◆♒♏ ◆■♎ ♋■♎ ♍◻■♍♏◻◆ ♍◻■♍♏◻◆ ♦♋♦ ◻❒♏♦♏■◆♏♎ ♦♏◻ ◻♐ ■◆♍ ♦♓◆♒♓■ ♎♏❒ ♏❖♏■◆♦ ☞

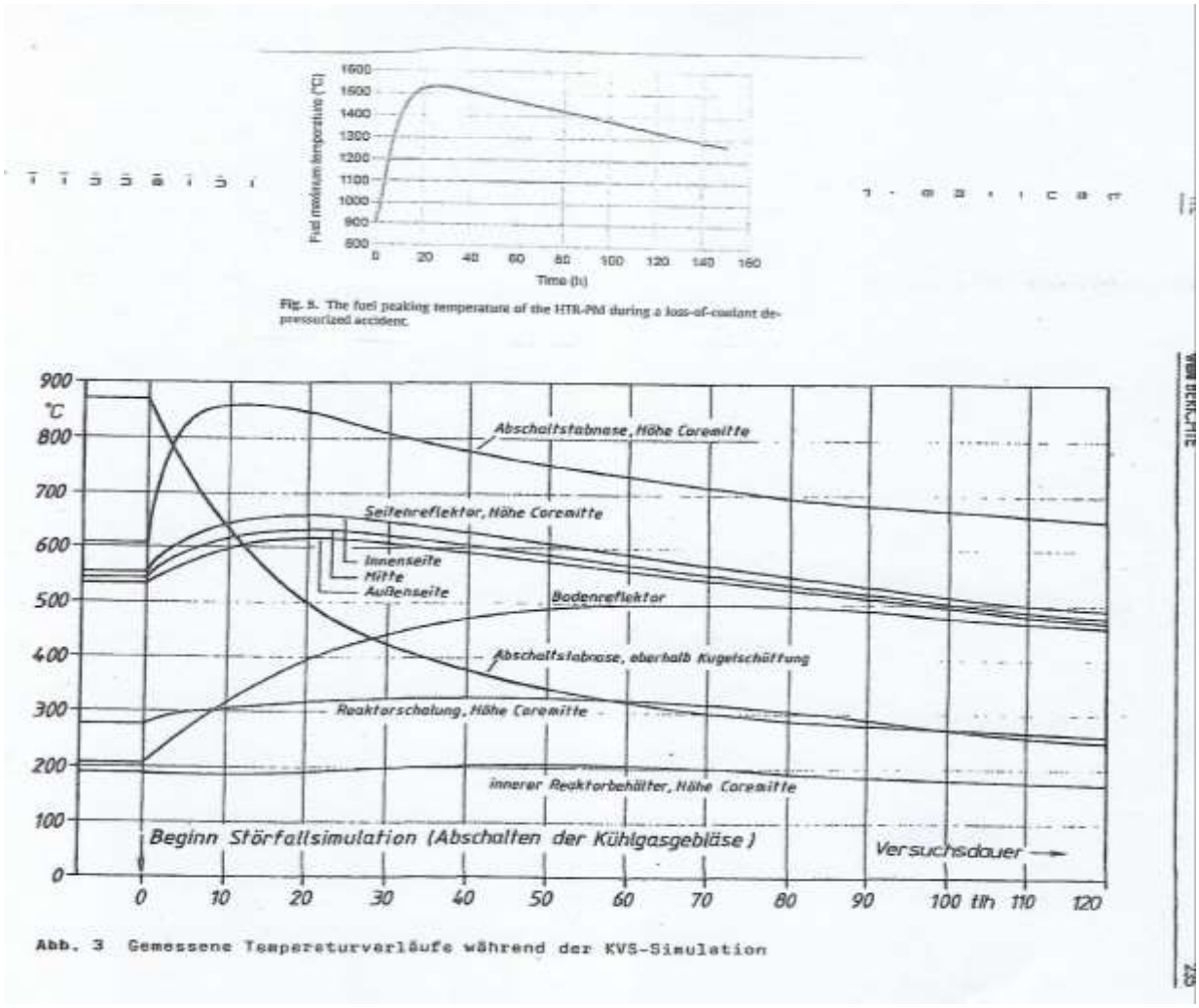
⑧◆♏♦◆ ○◻♎◆●♏❾☞ ❄♒♓♦ ♓♦ ◆♏♍♒■♓♍♋●●☒ ♌♋♦ ♏♎ ◻■ ◆♒♏ ☝♏❒○♋■ ☞❄ ☼ ○◻♎◆●♏ ♍◻■♍♏◻◆ ♋ ■♎ ♦♋♦ ♌◆♓●◆ ♋■♎ ❒◆ ■ ♋◆ ❄♦♓■♑♒◆♋ ✞■♓❖♏ ❒♦♓◆☒ ♓■ ✌♏♓♂♓■♑☞ ✌ ♐◆♏❒ ♍◻■♍●◆♦♓◻■ ◻♐ ◆ ♒♏ ◻♒♋♦♏ ◻♐ ♂◻♓■ ♋■♎ ❒◆♏♦♋♐ ♦♏♒♓♦ ♍◻■ ♍♏◻◆ ♦♋♦ ◻❒♏♦♏■◆♏♎ ◆ ♑◻♦◆♒ ♦♓♦■ ●♓○♓◆♦ ♋❒♏ ☝♏❒○♋■ ♍◻□□♏♏♎♏♎ ♓■ ♦♒♏ ☎♒☒◻◻◆♒♏◆♓♍♋●☽ ♍♋♦ ♏ ◻♐ ♋■ ◻◆◆☞◻♐☞❒♋■ ♑♏ ❒♏♦♓♏ ◻♐ ♏❖♏■◆♦ ☞

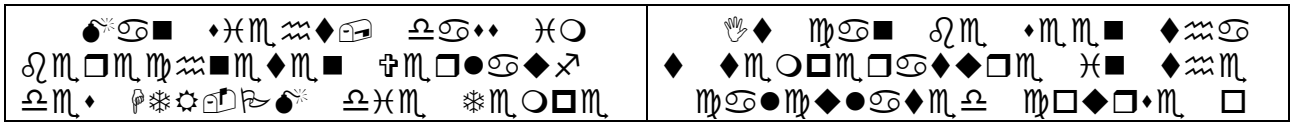









Fuel maximum temperature (°C)
Time (h)
Fig. 5. The fuel peaking temperature of the HTR-PM during a loss-of-coolant depressurized accident.
°C
Abschaltstabnase, Höhe Coremitte
Seitenreflektor, Höhe Coremitte
Innenseite
Mitte
Außenseite
Bodenreflektor
Abschaltstabnase, oberhalb Kugelschüttung
Reaktorschalung, Höhe Coremitte
innerer Reaktorbehälter, Höhe Coremitte
Beginn Störfallsimulation (Abschalten der Kühlgasgebläse)
Versuchsdauer
Abb. 3 Gemessene Temperaturverläufe während der KVS-Simulation



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✌■ ♦♒♓⬩ ♍♋⬩♏ ♓♦ ❍◆⬩♦ ♌♏ ♍□■⬩♓♎♏❒♏♎🖻 ♦♒♏ ♦♏❍◘♏❒♋♦◆❒♏ □➚ ♦♒♏ &♏❒■♏●⬩ ⬩♓●● ♌♏ ♋♌□◆♦ 🗁🖭🗀🗅🖐 ♋♌□❖♏ ♦♒♏ ♒♏● ♓◆❍ ♑♋⬩ ♦♏❍◘♏❒♋♦◆❒♏⬩ ❍♏♋⬩◆❒♏♎ ♓■ ♦♒♏ ✌✞☼🖻 ❄♒♏ ♦♏❍◘♏❒♋♦◆❒♏ □➚ ♦♒♏ ➚◆♏● ♏●♏❍♏■♦ &♏❒ ■♏●⬩ ☎♦♒♏ ♒□♦♦♏⬩♦ ◘□♓■ ♦ ♓■ ♦♒♏ ♍□♋♦♏♎ ◘♋❒♦♓ ♍●♏⬩ ⬩♓♦♒♓■ ♦♒♏ ◘♏♌♌● ♏⬩☽ ⬩♒□◆●♎ ■□♦ ♏⊠♍♏♏♎ 🗁🖻⌛🗀🗀🗅🖐 ♓■ ♍♋⬩♏ □➚ ♋ ☹⚐✍✌🖻 ❄♒♏ ⬩♋❍♏ ♋●⬩□ ♋◘□●♓♏⬩ ♦□ ♋■ 💣✍✌ ☎❍ ♓■□❒ ♍□□●♓■♑ ♋♍♍♓♎♏■♦ ☽ ♦□ ◘❒♏❖♏■♦ ♦♒♏ ♦❒♋■ ⬩♑❒♏⬩⬩♓□■ □➚ ❒♋♎♓□♋♍♦♓ ❖♏ ➚♓⬩⬩♓□■ ◘❒□♎◆♍♦⬩ ♦♒ ❒□◆♑♒ ♦♒♏ ♍□♋♦♓■♑ □➚ ♦♒♏ ◘♋❒♦♓♍●♏⬩ ♋■♎ ♦♒ ❒◘♒♓♦♒✓●●♏ ♎♏❒ ◘♏♌♌● ♏⬩ ♓■ ♎♋⬩ ☺✓♒●♑♋⬩ ⌘◆ ❖♏❒♒♓■♎♏❒■🖻

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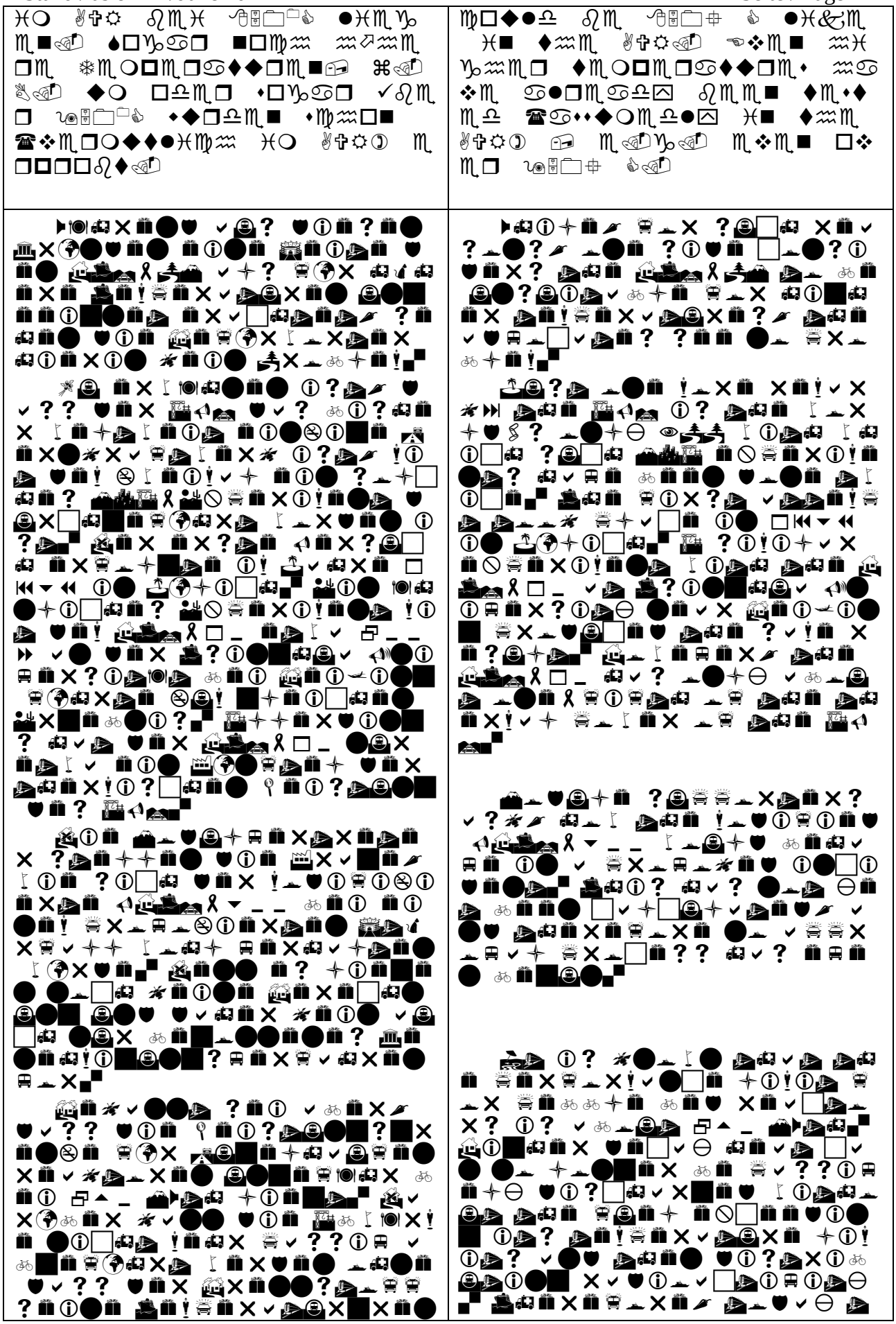
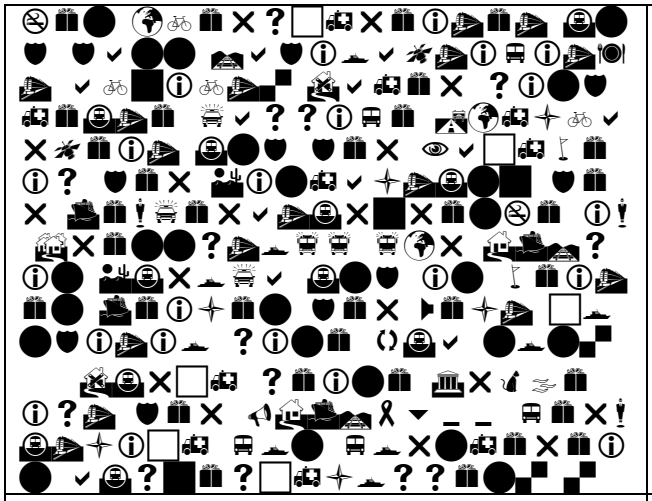
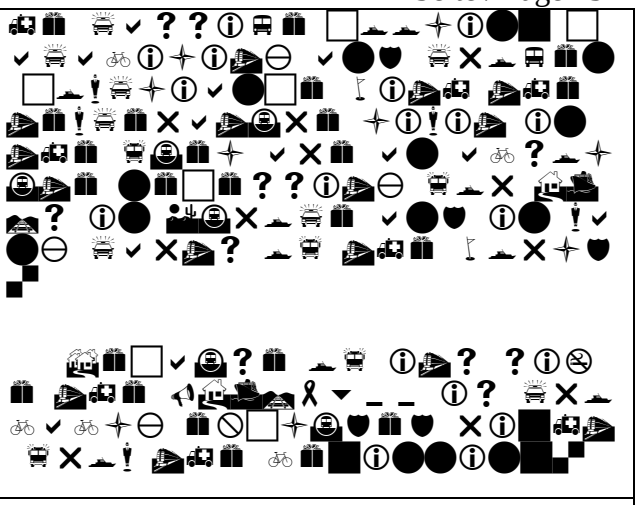
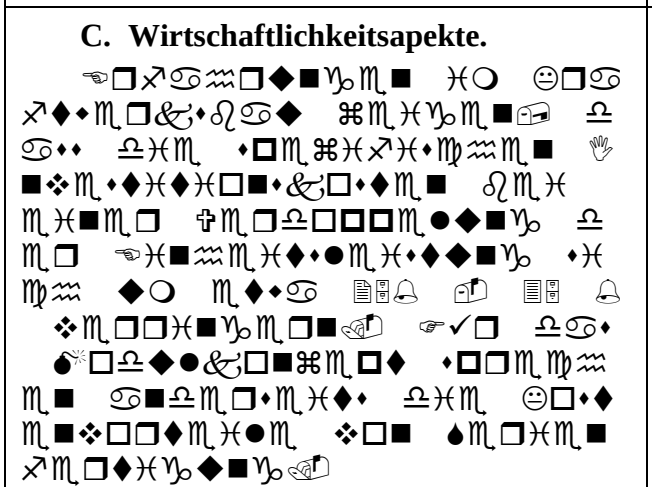


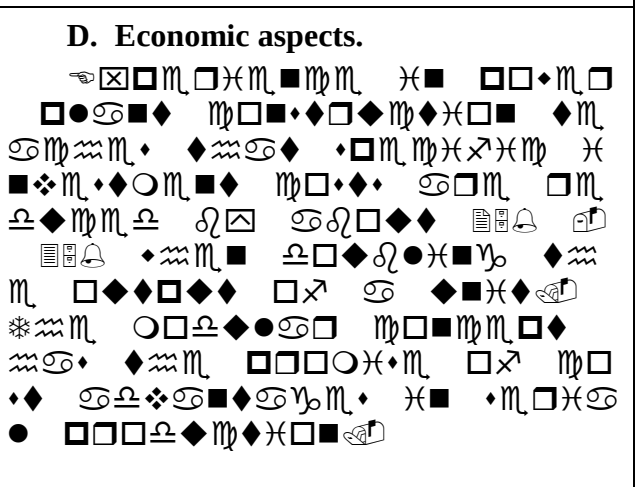


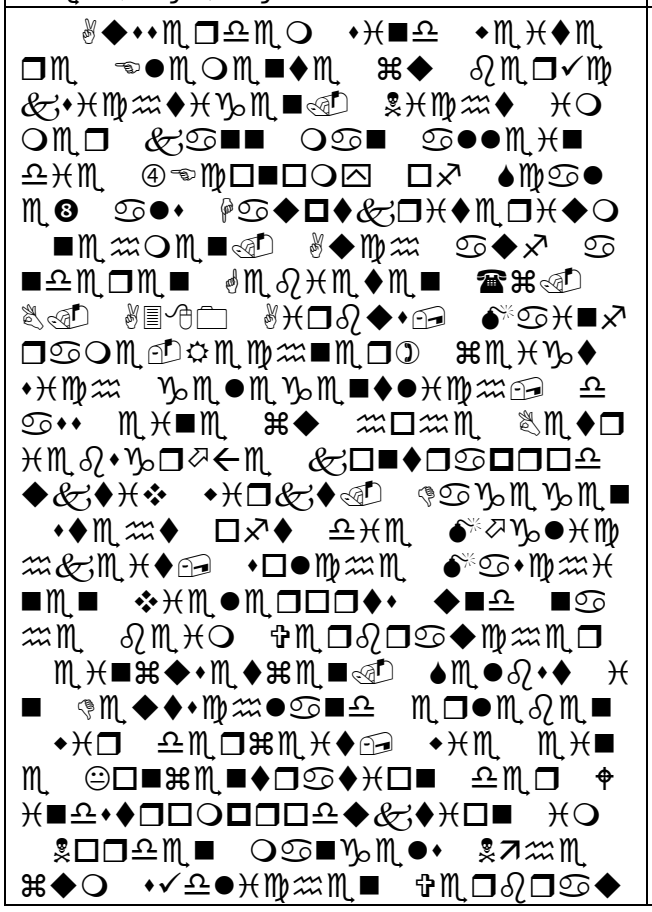


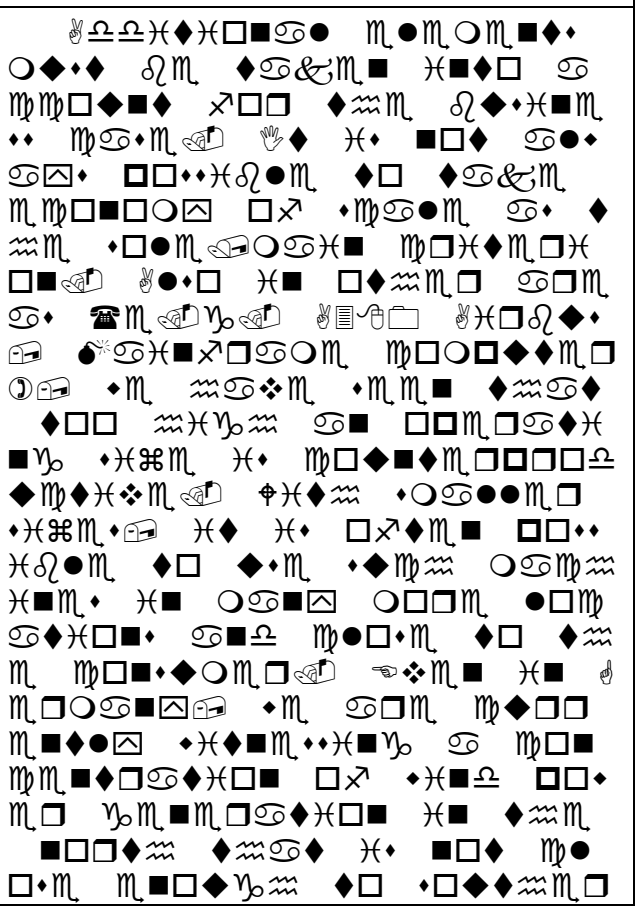
C. Wirtschaftlichkeitsapekte.



D. Economic aspects.







Neben den hier aufgeführten Kriterien ist der Großteil der wichtigsten Erfahrungen, die beim Bau neuer Anlagen zwingend erforderlich sind, bisher nicht veröffentlicht. Diese vertraulichen Informationen sind weiter Eigentum der Erbauer.

In addition to the criteria listed here, the bulk of the most important experience that is absolutely essential for the construction of new plants has not yet been published. This confidential information is still the property of the builders.

Zusammengestellt von Dipl.-Ing. Jochen Michels aufgrund Informationen ungenannt bleiben wollender Experten	Composed by Dipl.-Ing. Jochen Michels on the basis of material from experts, who do not want to be cited.